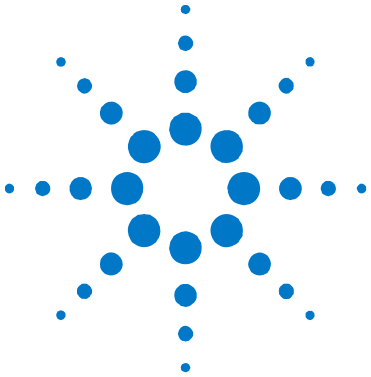

# Agilent W2637A, W2638A, and W2639A

## LPDDR BGA Probes and Oscilloscope Adapter Board

## User's Guide

Agilent Technologies

# Notices



## Manual Part Number

W2638-97002

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**CAUTION**

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# Contents

# 1. Introduction

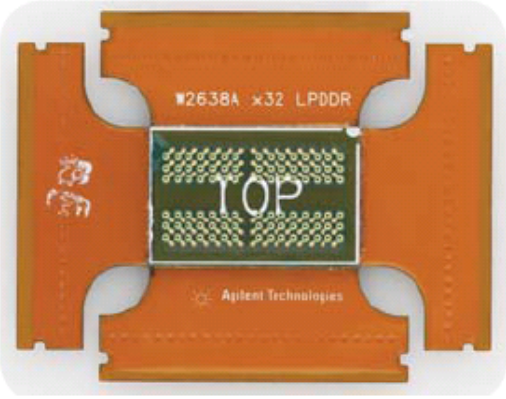
This document provides information for the following Agilent products:

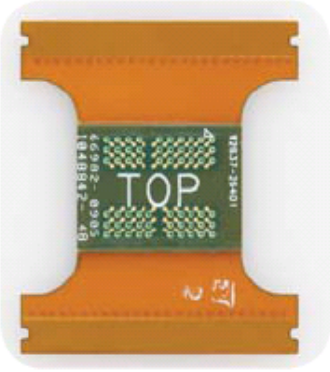
- W2637A LPDDR Probe (x16)
- W2638A LPDDR Probe (x32)
- W2639A Oscilloscope Adapter Board

The LPDDR (Low Power DDR) DRAM BGA probes enable logic analyzer state and timing measurements of all the DRAM buses, including the DQ, DQS, and clock signals of x16 and x32 DRAMs using the JEDEC standard common LPDDR DRAM footprint.

The probes interpose between the DRAM being probed and the PC board where the DRAM would normally be soldered. The probe is designed to be soldered to the PCB footprint for the DRAM. The DRAM being probed is then soldered to the top side of the probe

Each DRAM signal in the common footprint (including those defined for x16 and x32 DRAMs) passes directly from the bottom side of the probe to the top side of the probe. Buried probe resistors placed at the DRAM balls connect the probed signals to the rigid flex to mate with an Agilent cable adapter (ZIF probe). The W2637A/38A probes are also compatible with the Agilent InfiniiMax oscilloscope probes (E2678A single-ended/differential socketed probe heads). This allows oscilloscope probing of the DRAM signals with an Infiniium 80000 or 90000A Series oscilloscope, giving you a LPDDR testing solution covering the clock characterization, electrical and timing parameters of the JEDEC specification.



## Technical Feature Summary

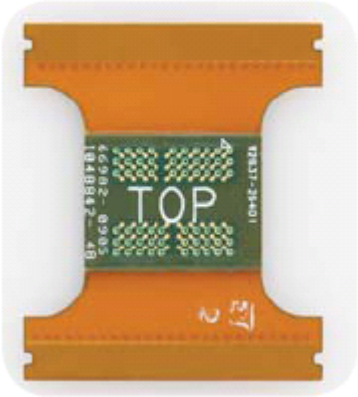
- Probing of LPDDR x16 and x32 DRAMs in BGA package using JEDEC standard common BGA footprint.
- Logic analyzer (using E5384A/E5826 single-ended ZIF probe) and oscilloscope (using E2678A InfiniiMax socketed probe head) connection to RAS#, CAS#, WE#, DQ, DQS/DQS#, and CK/CK# signals.
- Differential or single ended probing of DQS and CLK signals.
- Interposer design probes signals between DRAM BGA balls and DIMM.
- Use of separate E5384A and E5826A single ended probes for connection to the logic analyzer optimizes use of analyzer channels by allowing assignment of analyzer channels to 8 or 16 bits on each DRAM.
- Tin plating of the DRAM footprint on the top side of the probes is compatible with leaded and no-lead DRAM balls.
- Easy oscilloscope probing (no soldering) through ZIF connections and socketed probe heads.

## Why is LPDDR Used?

- Many embedded designs do not require the performance of DDR2 or DDR3.
- Do not want to change or re-design memory interface architecture.
- Requires little investment to bring down device power consumption.
- New applications – cell phones, networking devices, portable devices, etc.

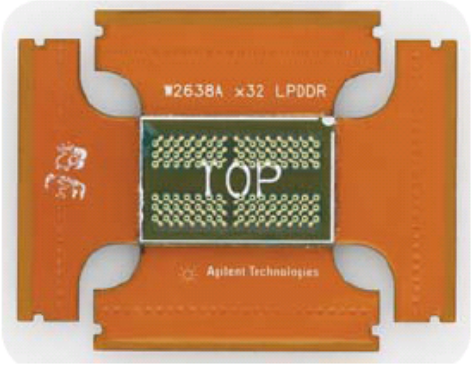
The following pictures show the W2637A and W2638A BGA probes, and the W2639A Oscilloscope Adapter Board.

## W2637A Top View



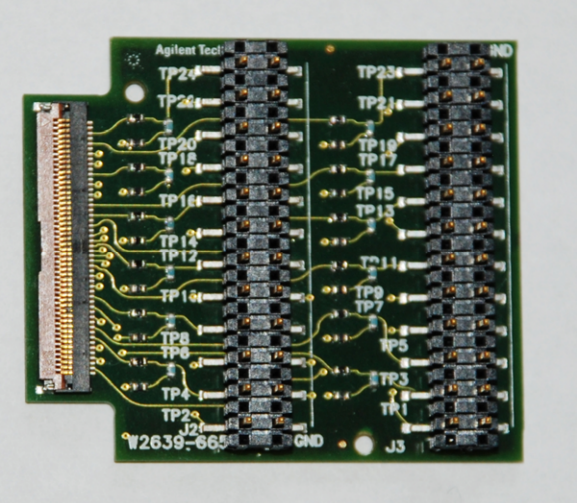

Top view (DRAM attach side)

## W2638A Top View




Top view (DRAM attach side)

## W2639A Top View




Top view

## Equipment Supplied

### W2637A and W2638A LPDDR BGA Probes

The following components have been shipped with your W2637A or W2638A LPDDR BGA probe (the first bullet shows the various ordering options and the number / type of probe(s) included with each):

- W2637A-101: kit of one W2637A LPDDR probe
  W2637A-102: kit of two W2637A LPDDR probes
  W2637A-104: kit of four W2637A LPDDR probes
  W2638A-101: kit of one W2638A LPDDR probe
  W2638A-102: kit of two W2638A LPDDR probes
  W2638A-104: kit of four W2638A LPDDR probes
- This *User's Guide.*

### W2639A Oscilloscope Adapter Board

- Each W2639A Oscilloscope Adapter Board order includes two oscilloscope adapter boards. Therefore, since the W2637A probe only uses two boards you will need to order W2639A once and since the W2638A probe uses four boards, you will need place two orders for W2639A.

## Equipment Required (when using probes with logic analyzer)

This section provides the configuration guide for probing x16 and x32 DRAM type with various data width. You will need:

- Agilent 16900-series logic analyzer system
- An appropriate number of Agilent logic analyzer cards connected together as a module.

**Logic Analyzer Configuration Guide**

| DRAM type | Data width | Access to signals | Access to signals | Cables | Logic Analyzer | Order summary |
|---|---|---|---|---|---|---|
| X16 | X16 | Command, Address, and Data | W2637A | E5384A | 16950Bx1 | 16950B: 1<br>E5384A: 1<br>W2637A |
| X32 | X32 | Command, Address, and Data | W2638A | E5384A | 16950Bx2 | 16950B: 1<br>E5384A: 1<br>E5826A: 1<br>W2638A |
| | | Data | | E5826A | | |

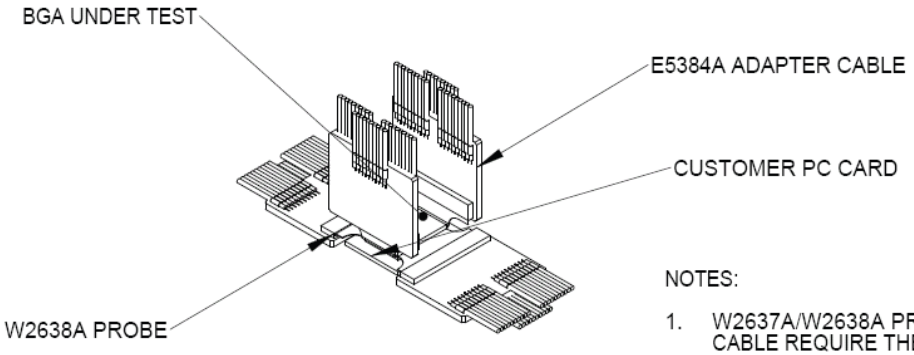
## Equipment Required (when using probes with oscilloscope)

In order to use the LPDDR BGA probes with an Infiniium oscilloscope, you will need the following equipment:

- If using W2637A: W2639A (x1)<br>If using W2638A: W2639A (x2)
- Agilent 80000 or 90000A Series oscilloscope
- Agilent InfiniiMax probe amplifier with E2678A single ended / differential socketed probe head and accessories

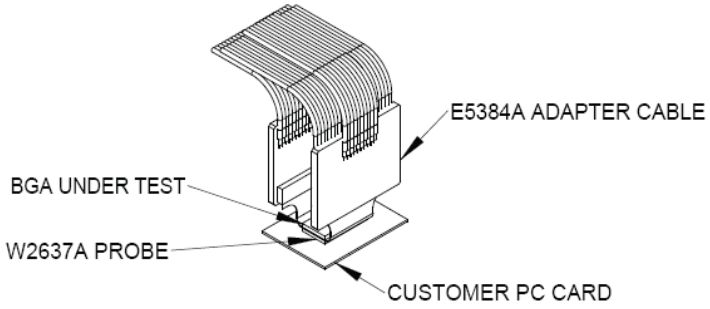
## Mechanical Considerations

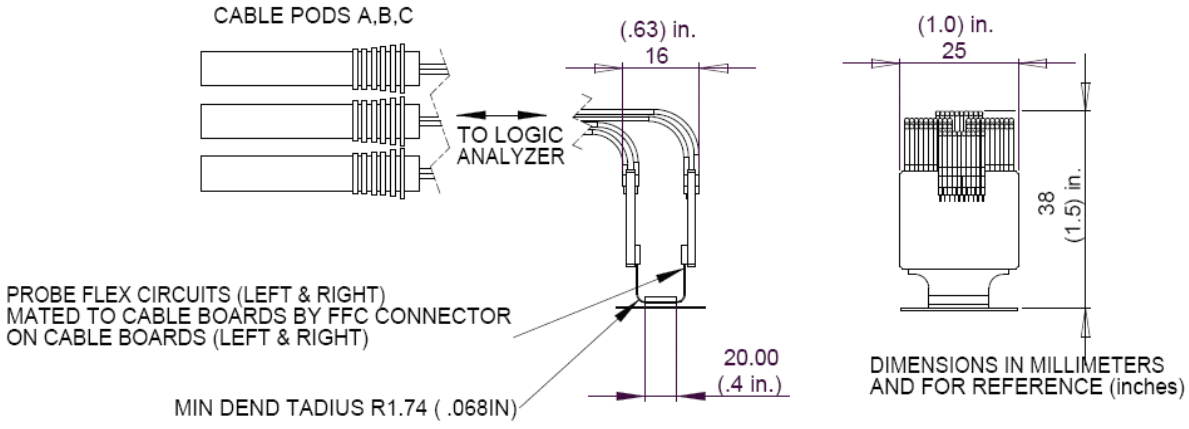
The following figures show the Keep Out Volume for various logic analyzer cables / adapters / probes when connected to the LPDDR Probes or the Oscilloscope Adapter Board.

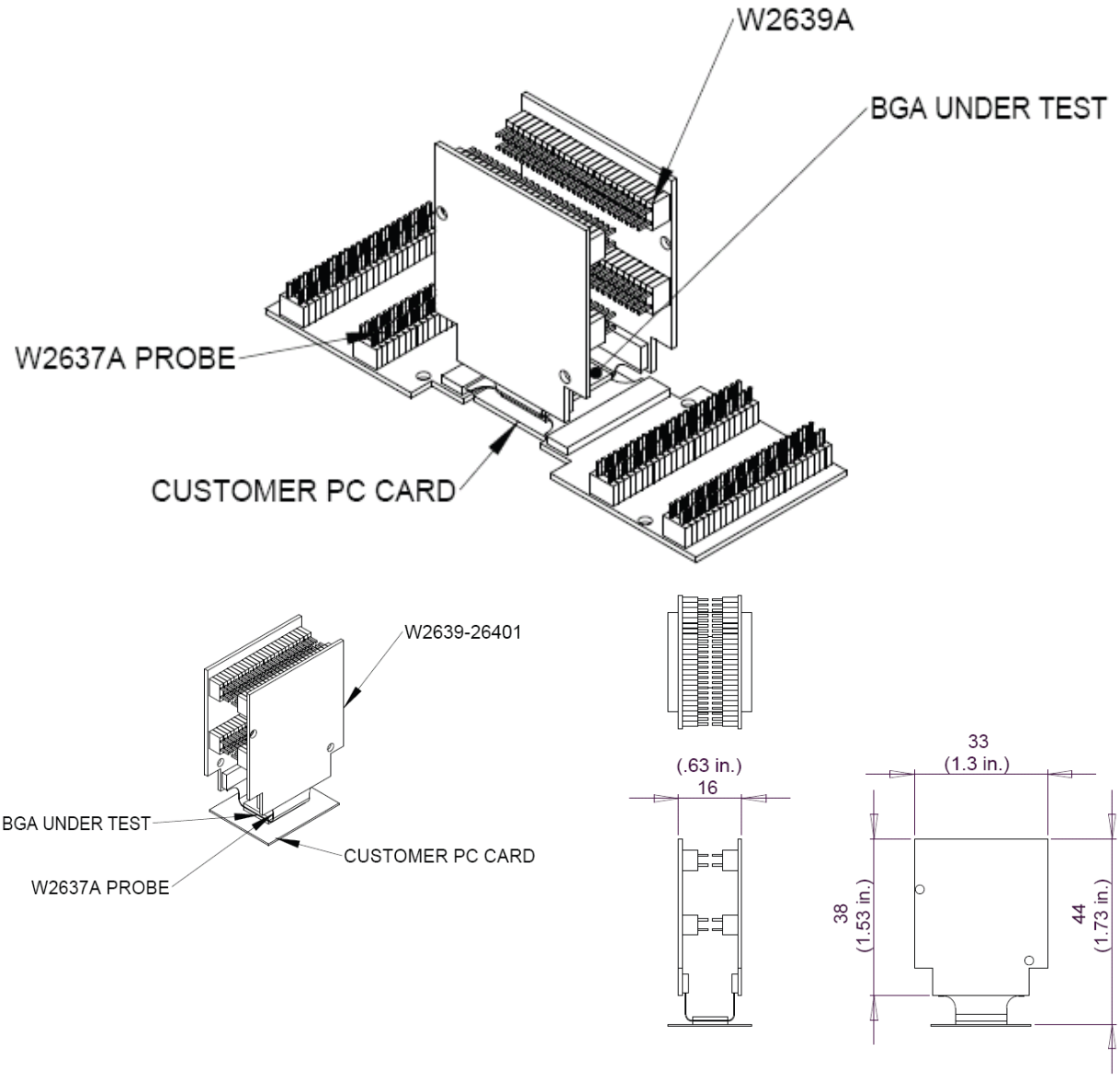


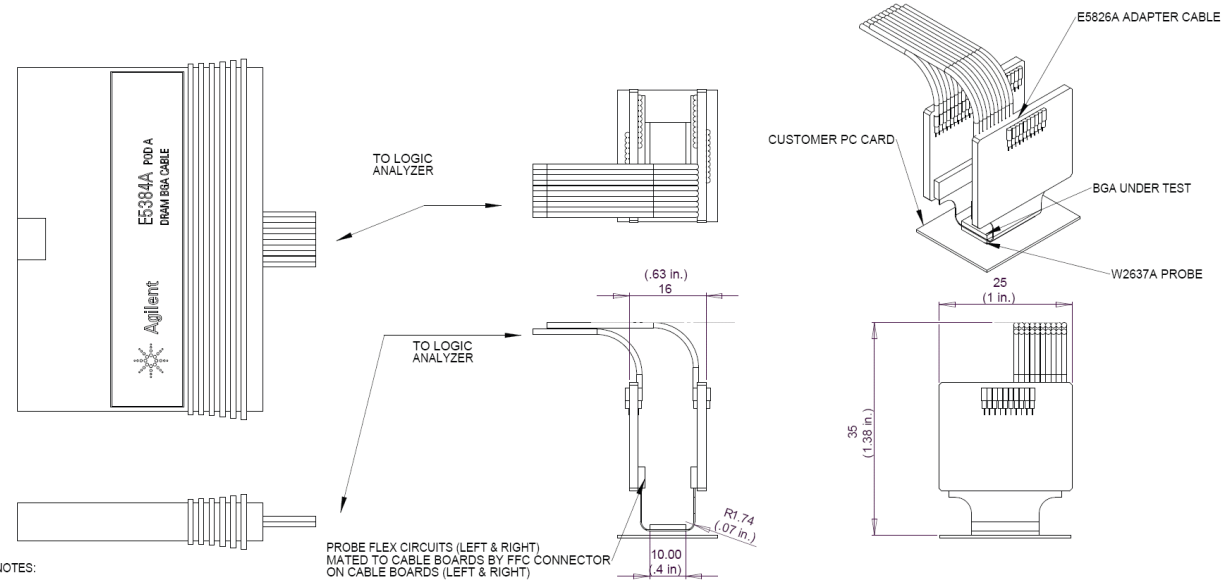

NOTES:

1. W2637A/W2638A PROBE AND E5384 ADAPTER CABLE REQUIRE THE X,Y,Z SPACE DEPICTED ON THIS DRAWING
2. KEEPOUT VOLUME WIDTH (16) IS SPECIFIED PER MINIMUM BEND RADIUS OF PROBE FLEX, WIDTH WILL BE 54 mm (2.10 in.).



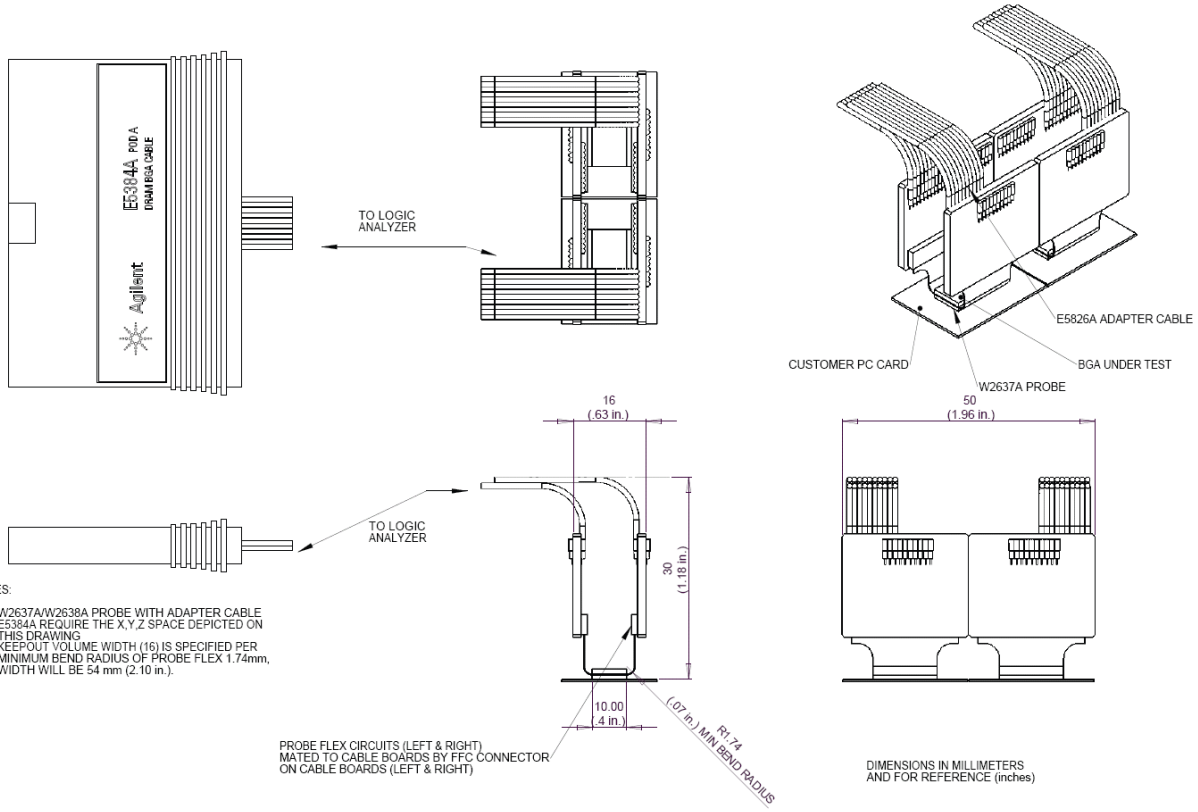

W2639A
BGA UNDER TEST
W2637A PROBE
CUSTOMER PC CARD
W2639-26401
BGA UNDER TEST
CUSTOMER PC CARD
W2637A PROBE
(.63 in.)
16
33
(1.3 in.)
38
(1.53 in.)
44
(1.73 in.)




NOTES:

1. W2637A/W2638A PROBE WITH ADAPTER CABLE E5384A REQUIRE THE X,Y,Z SPACE DEPICTED ON THIS DRAWING
2. KEEPOUT VOLUME WIDTH (16) IS SPECIFIED PER MINIMUM BEND RADIUS OF PROBE FLEX 1.74mm, WIDTH WILL BE 54 mm (2.10 in.).

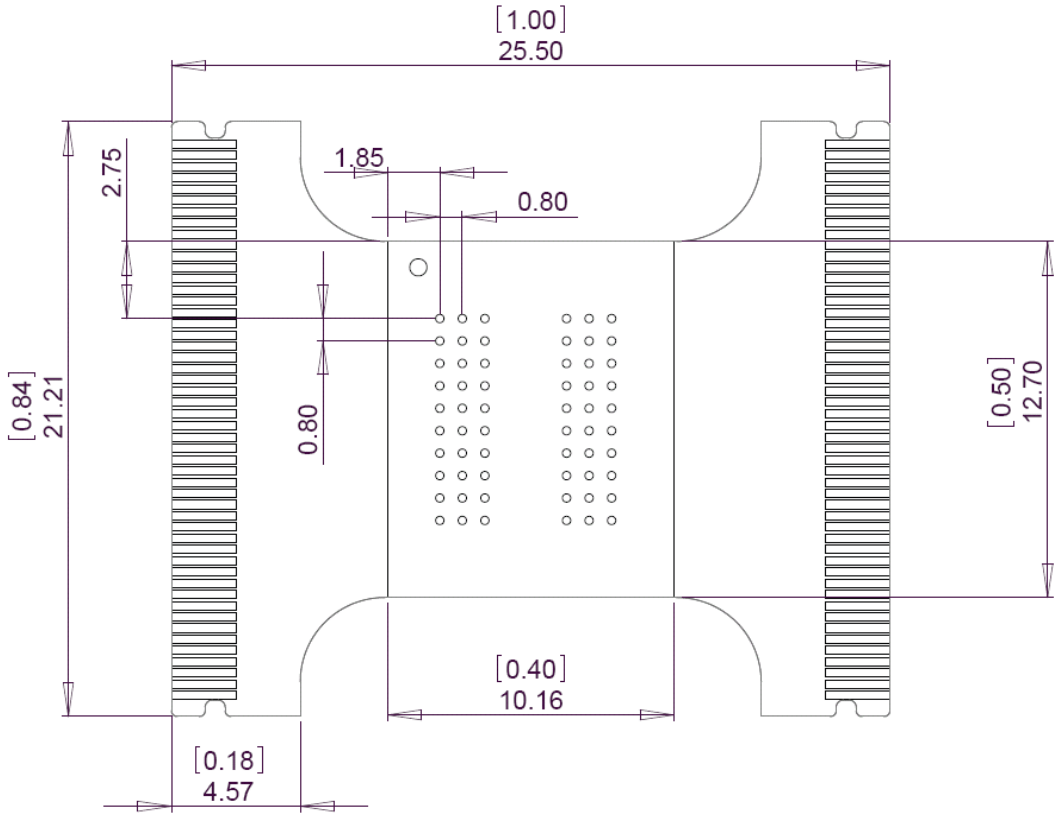
DIMENSIONS IN MILLIMETERS
AND FOR REFERENCE (inches)



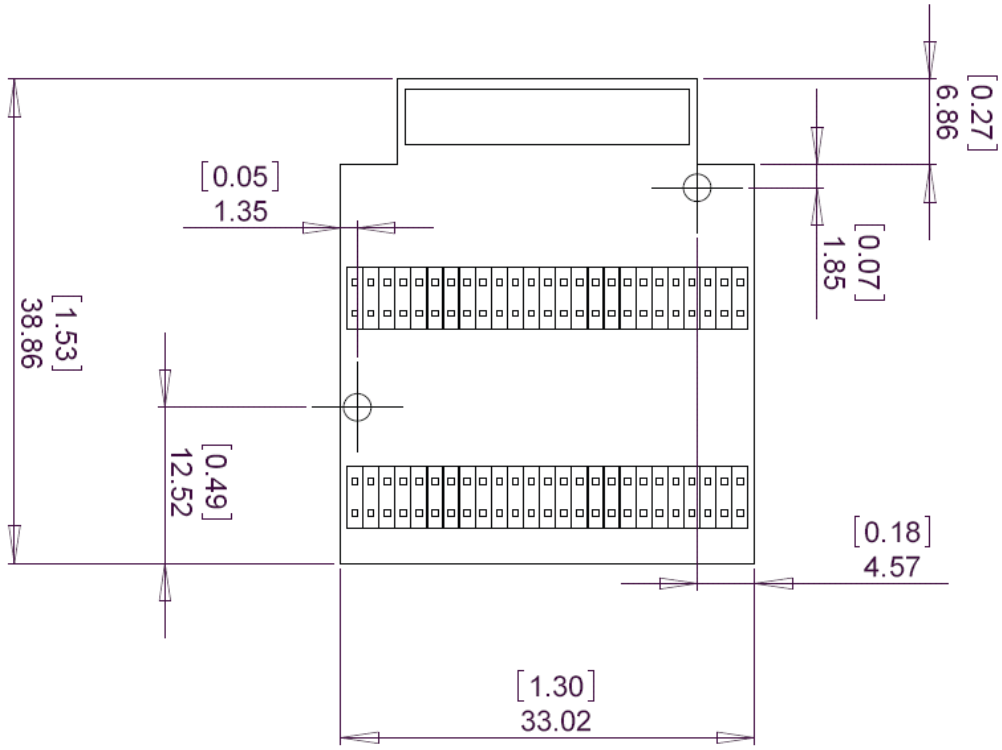

NOTES:

1. W2637A/W2638A PROBE WITH ADAPTER CABLE E5384A REQUIRE THE X,Y,Z SPACE DEPICTED ON THIS DRAWING
2. KEEPOUT VOLUME WIDTH (16) IS SPECIFIED PER MINIMUM BEND RADIUS OF PROBE FLEX 1.74mm, WIDTH WILL BE 54 mm (2.10 in.).

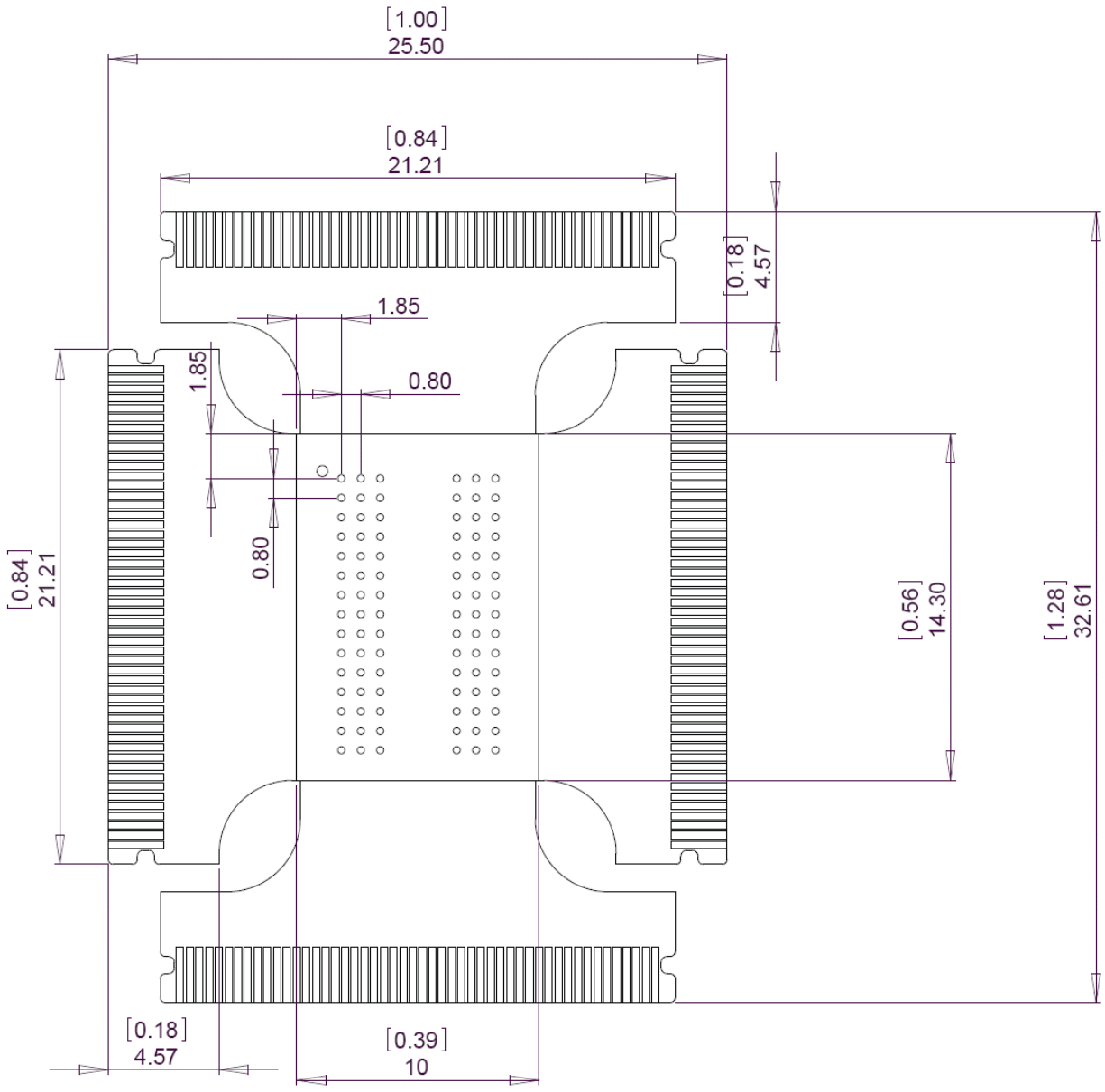
DIMENSIONS IN MILLIMETERS
AND FOR REFERENCE (inches)




**W2637A**




**W2639A**


[1.00]
25.50
[0.84]
21.21
[0.18]
4.57
1.85
1.85
0.80
0.80
[0.84]
21.21
[0.56]
14.30
[1.28]
32.61
[0.18]
4.57
[0.39]
10

**W2638A**

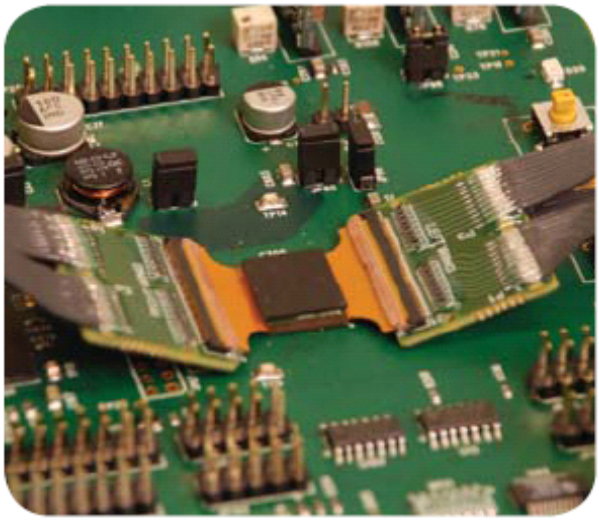
# 2. Installing the LPDDR BGA Probes

## Soldering the probe

The W2637A/38A BGA probes need to be attached to the DRAM PCB footprint on the design to be probed, and the desired DRAM is soldered to the top side of the probe. This attachment may occur in any order (i.e. first solder the probe to the DUT and then solder the DRAM to the probe, or first solder the DRAM to the probe and then solder the DRAM+probe assembly to the DUT). The probes are designed to tolerate lead-free soldering temperature profiles. However, it is always recommended to apply the minimum temperature required and the minimum number of heating/cooling cycles to reduce risk of any damage to the probes.

The probes are supplied without solder balls. Depending on the exact attachment order, either leaded or lead-free solder may be preferred to attach the probe to the DUT. The design of the probe supports either choice.

The flexible “wings” on the probes may need to be bent upwards before soldering to avoid mechanical contact with components adjacent to the probe on the DUT. This will ensure reliable connection when connected to the logic analyzer cable adapters.

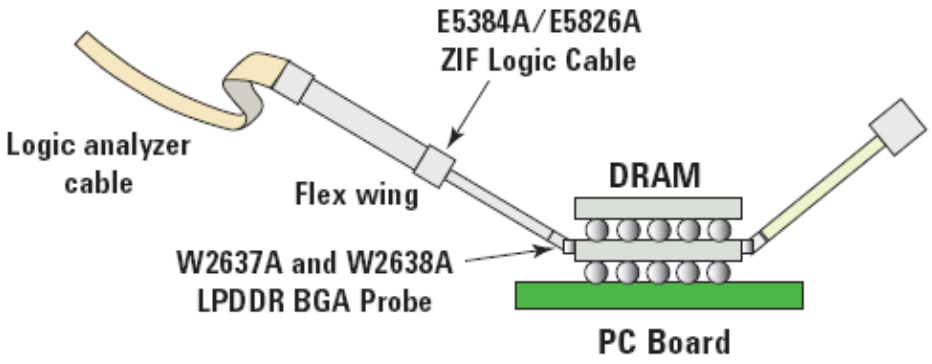


If you do not have the in-house expertise to attach the BGA probe adapter and DRAM, contract manufacturers with this expertise may be willing to perform the attachment for a fee. More information on BGA soldering and rework techniques that may be useful in attaching the probe can be found at:

- http://www.circuitrework.com/guides/9-0.shtml
- http://www.agilent.com/find/lpddrbga

## Logic Analyzer Connection to the LPDDR Probes

The W2637A LPDDR BGA probe connects to E5384A to provide connection to the logic analyzer for the x16 LPDDR package. The W2638A LPDDR BGA probe connects to E5384A and E5826A to provide connection to the logic analyzer for the x32 LPDDR package. The E5384A and/or E5826 plug into the 90-pin logic analyzer pod cable.




**LPDDR x16 E5384A Probe Cable Pin Assignment**

| Data Pod | | |
|---|---|---|
| Logic Channel | Signal Name | BGA Ref |
| 0 | DQ6 | D8 |
| 1 | DQ9 | D2 |
| 2 | DQ4 | C8 |
| 3 | DQ8 | E3 |
| 4 | DQ11 | C2 |
| 5 | DQ7 | E7 |
| 6 | DQ10 | D3 |
| 7 | DQ5 | D7 |
| 8 | DQ1 | B7 |
| 9 | DQ15 | A2 |
| 10 | DQ2 | B8 |
| 11 | DQ13 | B2 |
| 12 | DQ12 | C3 |
| 13 | DQ3 | C7 |

| Control Pod | | |
|---|---|---|
| Logic Channel | Signal Name | BGA Ref |
| 0 | BA1 | H9 |
| 1 | CAS# | G8 |
| 2 | WE# | G7 |
| 3 | RAS# | G9 |
| 4 | CS# | H7 |
| 5 | BA0 | H8 |
| 6 | LDQS | E8 |
| 7 | NC | |
| 8 | LDM | F8 |
| 9 | UDM | F2 |
| 10 | UDQS | E2 |
| 11 | NC | |
| 12 | - | |
| 13 | - | |

| Address Pod | | |
|---|---|---|
| Logic Channel | Signal Name | BGA Ref |
| 0 | NC | |
| 1 | A2 | K7 |
| 2 | A10 | J7 |
| 3 | NC | |
| 4 | A3 | K8 |
| 5 | A7 | J2 |
| 6 | A5 | K3 |
| 7 | A0 | J8 |
| 8 | A4 | K2 |
| 9 | A1 | J9 |
| 10 | A6 | J1 |
| 11 | A11 | H2 |
| 12 | A8 | J3 |
| 13 | A12, NC | H3 |

| | | |
|---|---|---|
| 14 | DQ14 | B3 |
| 15 | DQ0 | A8 |
| Clock_P | CKE | G1 |
| Clock_N | GND | |

| | | |
|---|---|---|
| 14 | - | |
| 15 | - | |
| Clock_P | CK | G2 |
| Clock_N | CK# | G3 |

| | | |
|---|---|---|
| 14 | A9 | H1 |
| 15 | A13 | F7 |
| Clock_P | - | |
| Clock_N | - | |

**LPDDR x32 E5384A and E5826A Probe Cable Pin Assignment**

Logic Analyzer Cable #1 (E5384A)

| **Data Pod** | | |
|---|---|---|
| LA Channel | Signal Name | BGA Ref |
| 0 | DQ4 | N8 |
| 1 | DQ11 | N2 |
| 2 | DQ2 | P8 |
| 3 | DQ13 | P2 |
| 4 | DQ15 | R2 |
| 5 | DQ0 | R8 |
| 6 | DQ9 | M2 |
| 7 | DQ6 | M8 |
| 8 | DQ18 | B8 |
| 9 | DQ29 | B2 |
| 10 | DQ20 | C8 |
| 11 | DQ27 | C2 |
| 12 | DQ25 | D2 |
| 13 | DQ22 | D8 |
| 14 | DQ31 | A2 |
| 15 | DQ16 | A8 |
| Clock_P | CKE | G1 |
| Clock_N | GND | |

| **Control Pod** | | |
|---|---|---|
| LA Channel | Signal Name | BGA Ref |
| 0 | DQS0 | L8 |
| 1 | DM0 | K8 |
| 2 | BA0 | H8 |
| 3 | BA1 | H9 |
| 4 | DQS1 | L2 |
| 5 | DM1 | K2 |
| 6 | RAS# | G9 |
| 7 | CAS# | G8 |
| 8 | WE# | G7 |
| 9 | DM2 | F8 |
| 10 | DQS2 | E8 |
| 11 | DM3 | F2 |
| 12 | - | |
| 13 | - | |
| 14 | - | |
| 15 | - | |
| Clock_P | CS# | |
| Clock_N | GND | |

| **Address Pod** | | |
|---|---|---|
| LA Channel | Signal Name | BGA Ref |
| 0 | A5 | K3 |
| 1 | A2 | K7 |
| 2 | A10 | J7 |
| 3 | A4 | K1 |
| 4 | A3 | K9 |
| 5 | A11 | H2 |
| 6 | A8 | J3 |
| 7 | A0 | J8 |
| 8 | A7 | J2 |
| 9 | A1 | J9 |
| 10 | A12 | H3 |
| 11 | NC | |
| 12 | A6 | J1 |
| 13 | NC | |
| 14 | A9 | H1 |
| 15 | NC | |
| Clock_P | - | |
| Clock_N | - | |

Logic Analyzer Cable #2 (E5826A)

| **Data Pod** | | |
|---|---|---|
| LA Channel | Signal Name | BGA Ref |
| 0 | DQ19 | C7 |
| 1 | DQ3 | N7 |
| 2 | DQ21 | D7 |
| 3 | DQ5 | M7 |
| 4 | DQ7 | L7 |
| 5 | DQ23 | E7 |
| 6 | DQ1 | P7 |
| 7 | DQ17 | B7 |
| 8 | DQ26 | D3 |
| 9 | DQ10 | M3 |
| 10 | DQ28 | C3 |
| 11 | DQ12 | N3 |
| 12 | DQ14 | P3 |
| 13 | DQ30 | B3 |
| 14 | DQ8 | L3 |
| 15 | DQ24 | E3 |
| Clock_P | CK | G2 |
| Clock_N | CK# | G3 |

**W2637A x16 LPDDR BGA Probe Pin-Out**

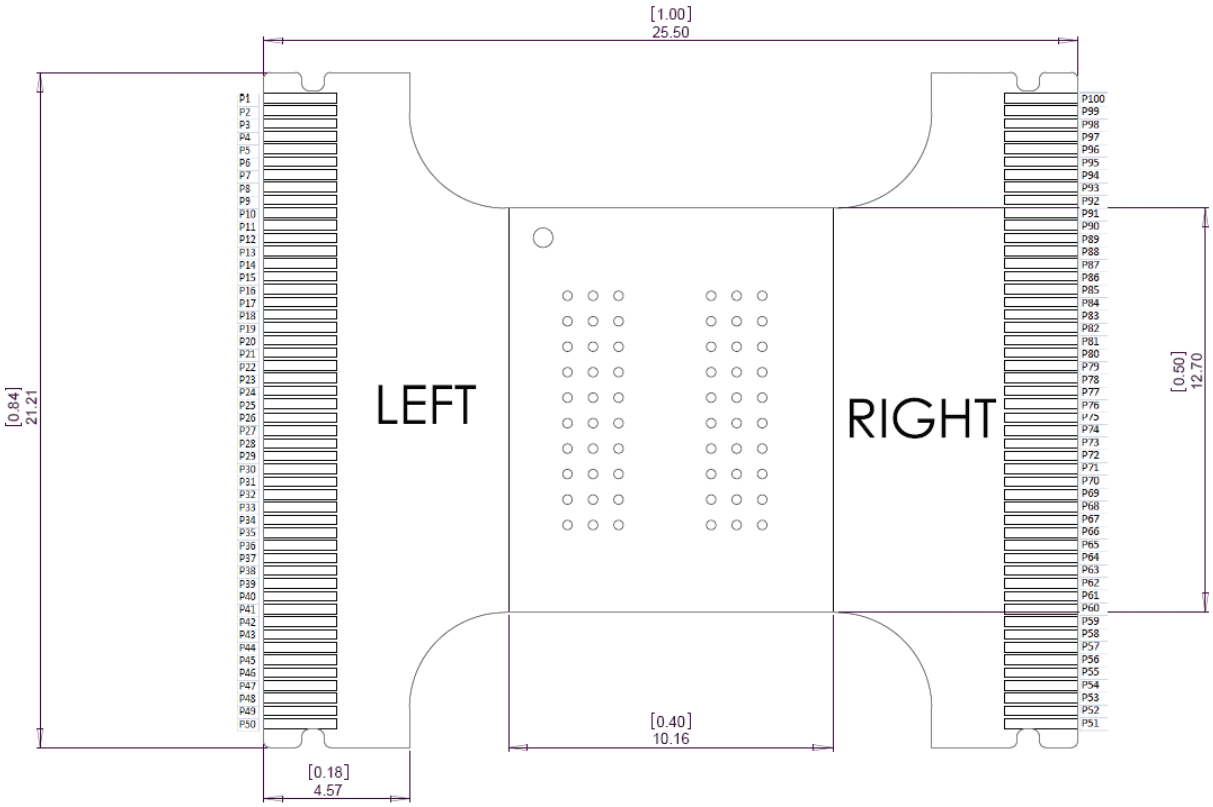
| Left Flex Wing (E5384A) | | | Right Flew Wing (E5384A) | | |
|---|---|---|---|---|---|
| **Pin** | **Signal Name** | **Group** | **Pin** | **Signal Name** | **Group** |
| All odd pins | GND | - | All odd pins | GND | - |
| 2 | NC | - | 100 | GND | - |
| 4 | DQ14 | Data | 98 | DQ0 | Data |
| 6 | DQ15 | Data | 96 | DQ1 | Data |
| 8 | DQ13 | Data | 94 | DQ2 | Data |
| 10 | DQ12 | Data | 92 | DQ3 | Data |
| 12 | UDQS | Data | 90 | GND | - |
| 14 | DQ10 | Data | 88 | CKE | Command |
| 16 | DQ9 | Data | 86 | DQ5 | Data |
| 18 | DQ8 | Data | 84 | DQ6 | Data |
| 20 | DQ11 | Data | 82 | DQ4 | Data |
| 22 | UDM | Data | 80 | DQ7 | Data |
| 24 | LDM | Data | 78 | CK | Command |
| 26 | NC | - | 76 | CK# | Command |
| 28 | LDQS | Data | 74 | RASH# | Command |
| 30 | BAD | Command | 72 | WE# | Command |
| 32 | CS# | Command | 70 | CAS# | Command |
| 34 | A9 | Address | 68 | BA1 | Command |
| 36 | A7 | Address | 66 | A13 | Address |
| 38 | A6 | Address | 64 | A12 | Address |
| 40 | A8 | Address | 62 | A11 | Address |
| 42 | A4 | Address | 60 | A1 | Address |
| 44 | A5 | Address | 58 | A0 | Address |
| 46 | NC | - | 56 | A10 | Address |
| 48 | NC | - | 54 | A3 | Address |
| 50 | GND | - | 52 | A2 | Address |

**W2638A x32 LPDDR BGA Probe Pin-Out**

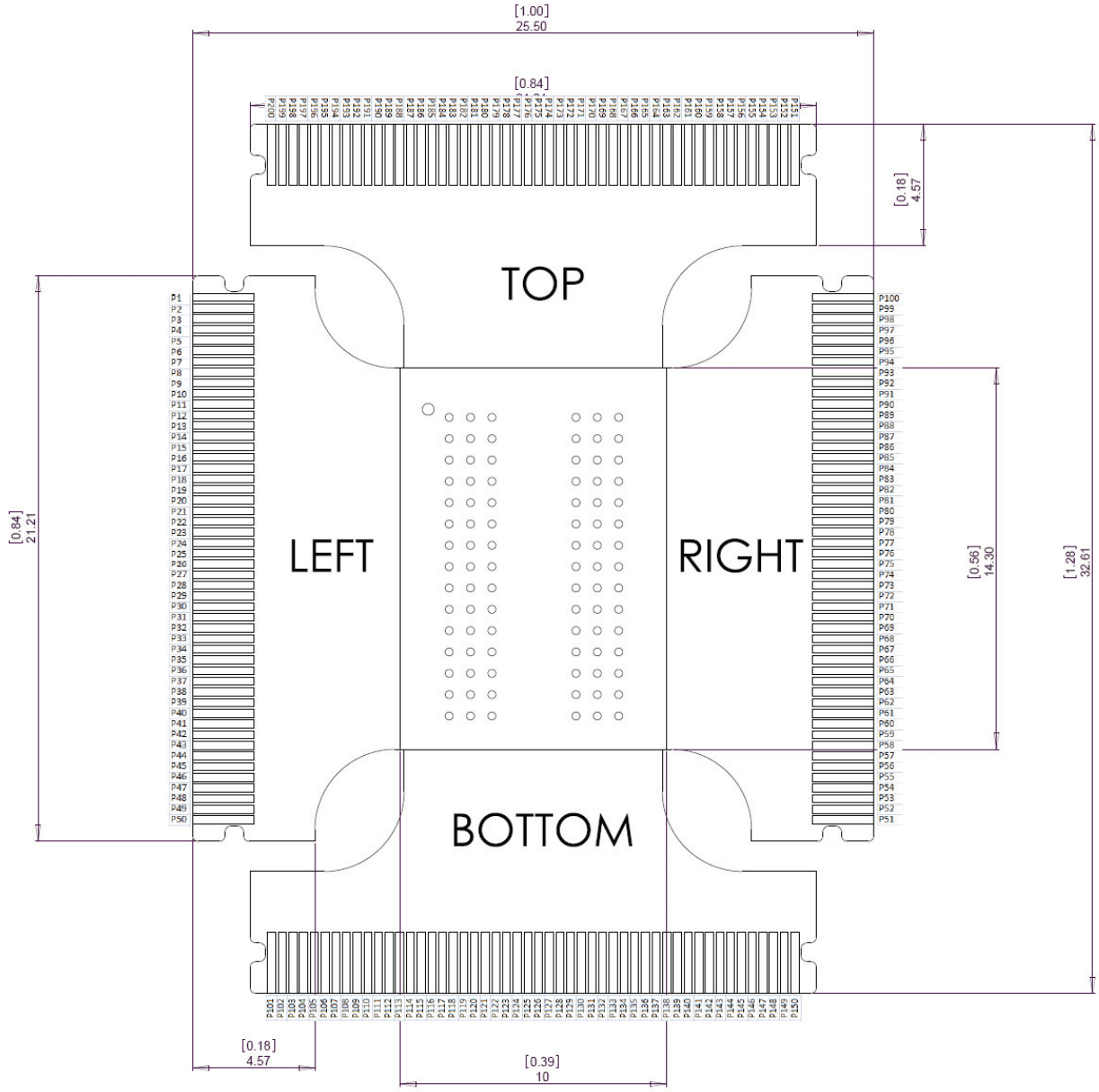
| Left Flex Wing (E5384A) | | | Right Flew Wing (E5384A) | | |
|---|---|---|---|---|---|
| **Pin** | **Signal Name** | **Group** | **Pin** | **Signal Name** | **Group** |
| All odd pins | GND | - | All odd pins | GND | - |
| 2 | DM3 | Data | 100 | GND | - |
| 4 | DQ31 | Data | 98 | DQ16 | Data |
| 6 | DQ29 | Data | 96 | DQ18 | Data |
| 8 | DQ27 | Data | 94 | DQ20 | Data |
| 10 | DQ25 | Data | 92 | DQ22 | Data |
| 12 | DQS2 | Data | 90 | GND | - |
| 14 | DQ9 | Data | 88 | CKE | Command |
| 16 | DQ11 | Data | 86 | DQ6 | Data |
| 18 | DQ13 | Data | 84 | DQ4 | Data |
| 20 | DQ15 | Data | 82 | DQ2 | Data |
| 22 | DM2 | Data | 80 | DQ0 | Data |
| 24 | WE# | Command | 78 | CS# | Command |
| 26 | CAS# | Command | 76 | GND | - |
| 28 | RAS# | Command | 74 | BA1 | Command |
| 30 | DM1 | Data | 72 | BA0 | Command |
| 32 | DQS1 | Data | 70 | DM0 | Data |
| 34 | A9 | Address | 68 | DQS0 | Data |
| 36 | A11 | Address | 66 | NC | - |
| 38 | A12 | Address | 64 | NC | - |
| 40 | A6 | Address | 62 | NC | - |
| 42 | A7 | Address | 60 | A1 | Address |
| 44 | A8 | Address | 58 | A0 | Address |
| 46 | A4 | Address | 56 | A10 | Address |
| 48 | A5 | Address | 54 | A3 | Address |
| 50 | GND | - | 52 | A2 | Address |

**W2638A x32 LPDDR BGA Probe Pin-Out (continued)**

| Bottom Flex Wing (E5826A) | | | Top Flew Wing (E5826A) | | |
|---|---|---|---|---|---|
| **Pin** | **Signal Name** | **Group** | **Pin** | **Signal Name** | **Group** |
| All odd pins | GND | - | All odd pins | GND | - |
| 102 | NC | - | 200 | GND | - |
| 104 | DQ8 | Data | 198 | DQ24 | Data |
| 106 | DQ10 | Data | 196 | DQ26 | Data |
| 108 | DQ12 | Data | 194 | DQ28 | Data |
| 100 | DQ14 | Data | 192 | DQ30 | Data |
| 112 | NC | - | 190 | GK# | Command |
| 114 | DQ1 | Data | 188 | CK | Command |
| 116 | DQ3 | Data | 186 | DQ17 | Data |
| 118 | DQ5 | Data | 184 | DQ19 | Data |
| 120 | DQ7 | Data | 182 | DQ21 | Data |
| 122 | NC | - | 180 | DQ23 | Data |
| 124 | NC | - | 178 | NC | - |
| 126 | NC | - | 176 | NC | - |
| 128 | NC | - | 174 | NC | - |
| 130 | NC | - | 172 | NC | - |
| 132 | NC | - | 170 | NC | - |
| 134 | NC | - | 168 | NC | - |
| 136 | NC | - | 166 | NC | - |
| 138 | NC | - | 164 | NC | - |
| 140 | NC | - | 162 | NC | - |
| 142 | NC | - | 160 | NC | - |
| 144 | NC | - | 158 | NC | - |
| 146 | NC | - | 156 | NC | - |
| 148 | NC | - | 154 | NC | - |
| 150 | GND | - | 152 | NC | - |



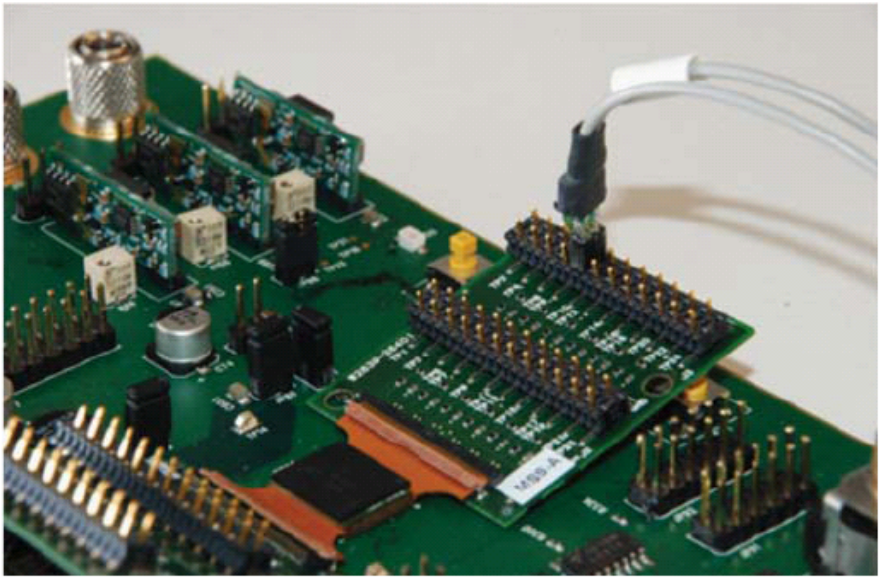

**W2637A**


[1.00]
25.50
[0.84]
[0.18]
4.57
TOP
LEFT
RIGHT
BOTTOM
[0.84]
21.21
[0.56]
14.30
[1.28]
32.61
[0.18]
4.57
[0.39]
10

**W2638A**

## Probing the W2639A Oscilloscope Adapter Board with an InfiniiMax Probe

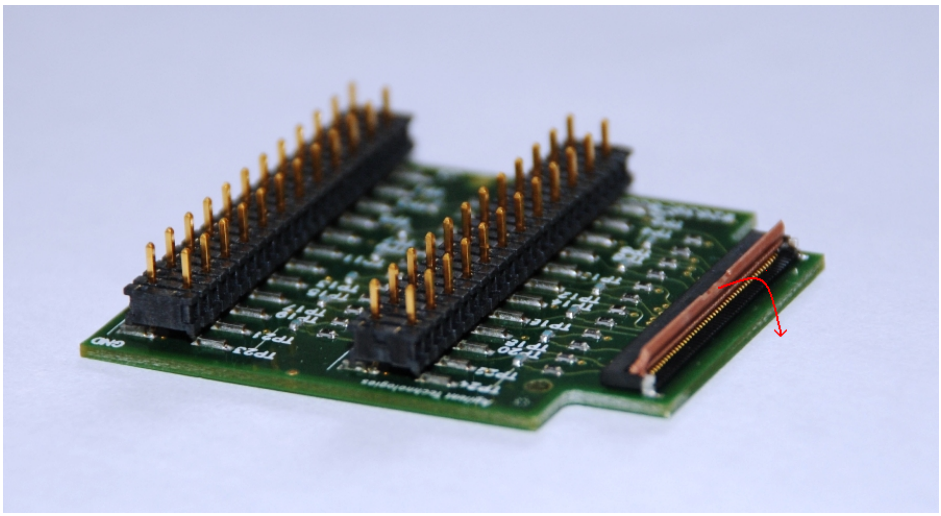
The picture below shows the W2637A LPDDR BGA probe connected to an oscilloscope via the W2639A LPDDR oscilloscope probe adapter board and E2678A socketed probe head. Note: The E2678A socketed probe head needs to be used with the damping adapter (01130-63201) to connect to the W2639A oscilloscope probe adapter board.

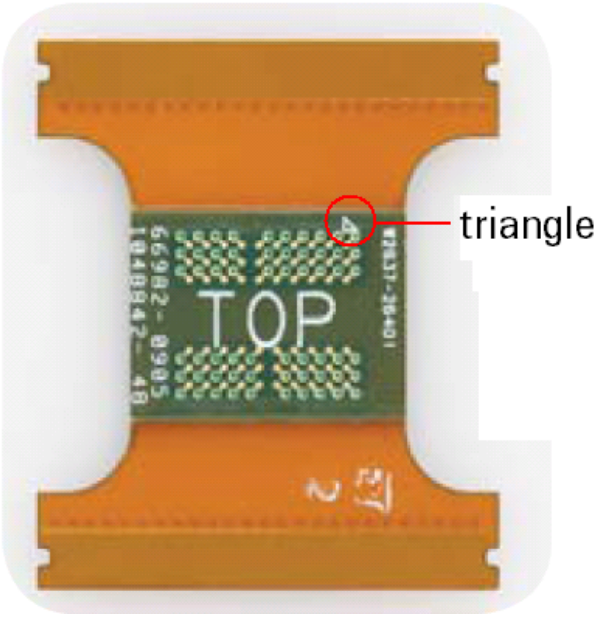
## Oscilloscope Connection to the W2637A/38A Series Probes

The LPDDR BGA probes are used with the Agilent E2678A socketed InfiniiMax probe head and the W2639A oscilloscope adapter boards to connect to an oscilloscope.

To connect to an oscilloscope, first solder the LPDDR BGA probe to the circuit board. Then attach the W2639A oscilloscope adapter boards to the “wings” of the LPDDR probes (two adapter boards for the W2637A (x16) probe and four for the W2638A (x32) probe). To attach these adapter boards to the wing, simply lift up on the ZIF connectors located on the probe, then insert the ZIF connector on the adapter board, and then close the probe ZIF connector to lock the assembly into position. The picture below shows the location of the ZIF connector as well as an arrow indicating how to close and lock the assembly into position.



Please note that the side labeled “TOP” on the LPDDR probes should be pointing upwards. Also, there is a small triangle in one of the corners (see picture below). This edge should be the top left corner.



Make sure you set the following values in the **Probe Setup** dialog box on your oscilloscope.

- Set the **Gain** setting by referring to the table / formula below. The voltage is halved due to termination resistors on the adapter board.

| Transmitter Termination, Tx | Receiver Termination, Rx | Probe Gain Factor |
|---|---|---|
| 100 | 100 | 0.24*, 0.20** |
| 75 | 75 | 0.26*, 0.21** |
| 50 | 50 | 0.27*, 0.22** |

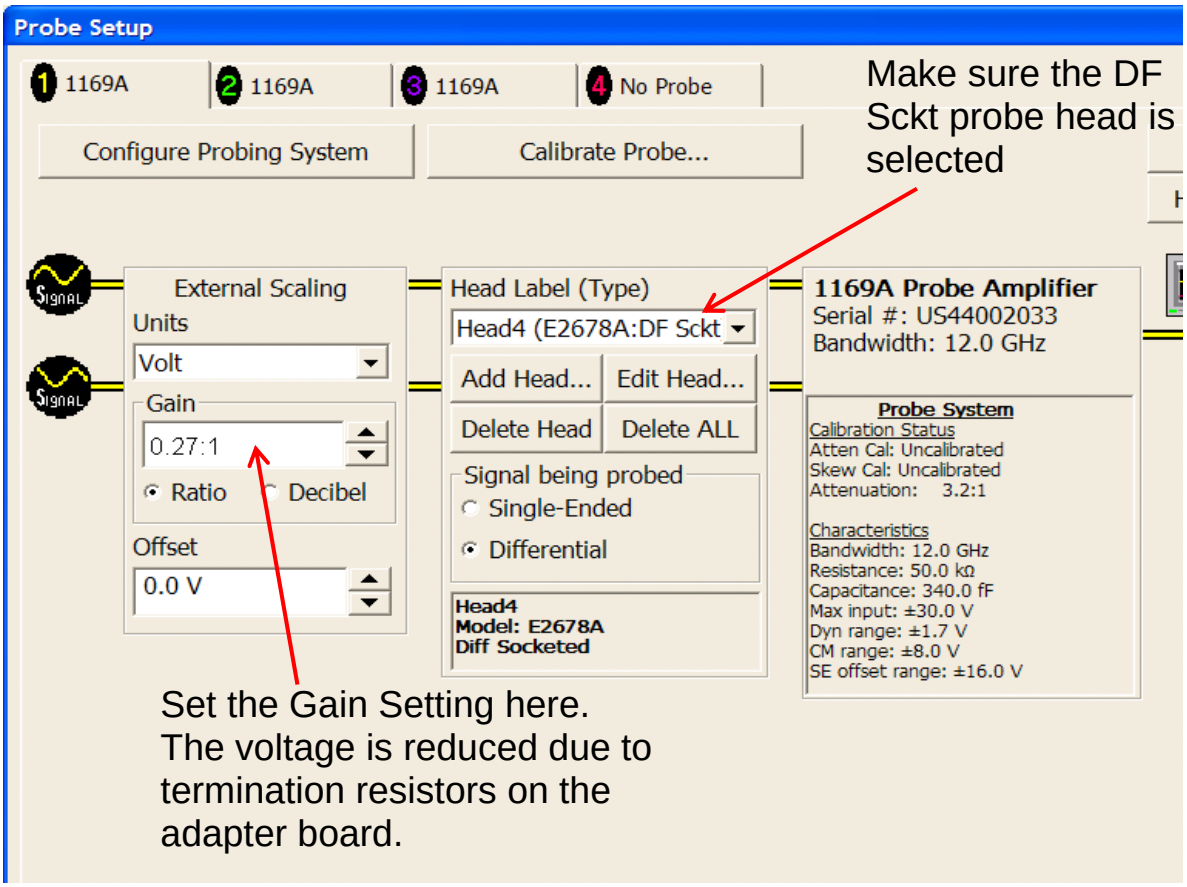
*for W2637A/W2638A (see formulas below)
**for W2631/32/33/34A and W3631/33A (see formulas below)

Probe Gain Factor = 60.4 / (x + y + 37.4 + 60.4)

where:

$x = [(1/Tx) + (1/Rx)]^{-1}$
y = 100 Ω for W2637A/W2638A
y = 150 Ω for W2631/32/33/34A and W3631/33A

- Make sure the DF Sckt probe head is selected in the **Head Label** field.



**W2639A LPDDR BGA Probe Adapter Board Pin-Out for W2637A x16 LPDDR BGA Probe**

| Left Flex Wing | | | | | | | Right Flex Wing | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Signal Name** | **Signal Name** | **Test Point** | | **Signal Name** | **Signal Name** | **Test Point** | **Test Point** | **Signal Name** | **Signal Name** | | **Test Point** | **Signal Name** | **Signal Name** |
| GND | NC | TP1 | | GND | DQ14 | TP2 | TP24 | DQ0 | GND | | TP23 | DQ1 | GND |
| GND | DQ15 | TP3 | | GND | DQ13 | TP4 | TP22 | DQ2 | GND | | TP21 | DQ3 | GND |
| GND | DQ12 | TP5 | | GND | DQ10 | TP6 | TP20 | GND | GND | | TP19 | DQ5 | GND |
| GND | UDQS | TP7 | | GND | DQ9 | TP8 | TP18 | CKE | GND | | TP17 | DQ6 | GND |
| GND | DQ8 | TP9 | | GND | DQ11 | TP10 | TP16 | DQ4 | GND | | TP15 | DQ7 | GND |
| GND | UDM | TP11 | | GND | NC | TP12 | TP14 | CK | GND | | TP13 | RAS# | GND |
| GND | LDM | TP13 | | GND | LDQS | TP14 | TP12 | CK# | GND | | TP11 | WE# | GND |
| GND | BA0 | TP15 | | GND | CS# | TP16 | TP10 | CAS# | GND | | TP9 | BA1 | GND |
| GND | A9 | TP17 | | GND | A6 | TP18 | TP8 | A13 | GND | | TP7 | A11 | GND |
| GND | A7 | TP19 | | GND | A8 | TP20 | TP6 | A12, NC | GND | | TP5 | A1 | GND |
| GND | A4 | TP21 | | GND | A5 | TP22 | TP4 | A0 | GND | | TP3 | A10 | GND |
| GND | NC | TP23 | | GND | NC | TP24 | TP2 | A3 | GND | | TP1 | A2 | GND |

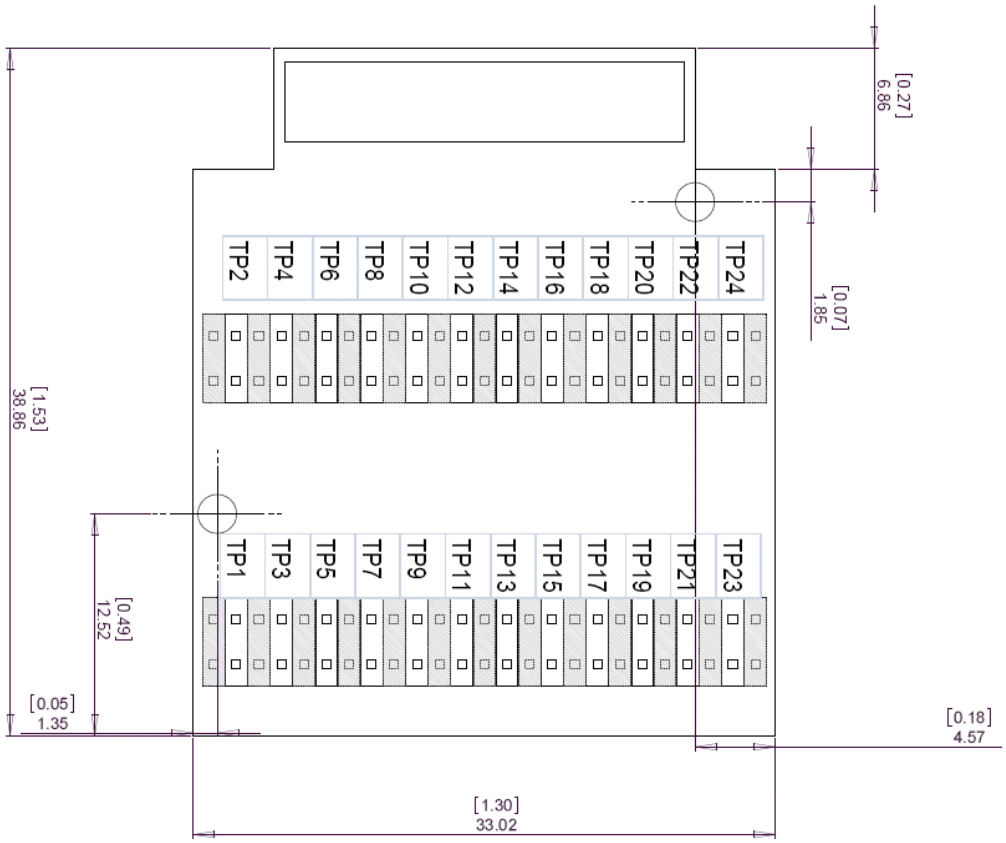
**W2639A LPDDR BGA Probe Adapter Board Pin-Out for W2638A x32 LPDDR BGA Probe**

| Left Flex Wing | | | | | | |
|---|---|---|---|---|---|---|
| **Signal Name** | **Signal Name** | **Test Point** | | **Signal Name** | **Signal Name** | **Test Point** |
| GND | DM3 | TP1 | | GND | DQ31 | TP2 |
| GND | DQ29 | TP3 | | GND | DQ27 | TP4 |
| GND | DQ25 | TP5 | | GND | DQ9 | TP6 |
| GND | DQS2 | TP7 | | GND | DQ11 | TP8 |
| GND | DQ13 | TP9 | | GND | DQ15 | TP10 |
| GND | DM2 | TP11 | | GND | CAS# | TP12 |
| GND | WE# | TP13 | | GND | RAS# | TP14 |
| GND | DM1 | TP15 | | GND | DQS1 | TP16 |
| GND | A9 | TP17 | | GND | A12 | TP18 |
| GND | A11 | TP19 | | GND | A6 | TP20 |
| GND | A7 | TP21 | | GND | A8 | TP22 |
| GND | A4 | TP23 | | GND | A5 | TP24 |

| Right Flex Wing | | | | | |
|---|---|---|---|---|---|
| **Test Point** | **Signal Name** | **Signal Name** | **Test Point** | **Signal Name** | **Signal Name** |
| TP24 | DQ16 | GND | TP23 | DQ18 | GND |
| TP22 | DQ20 | GND | TP21 | DQ22 | GND |
| TP20 | GND | GND | TP19 | DQ6 | GND |
| TP18 | CKE | GND | TP17 | DQ4 | GND |
| TP16 | DQ2 | GND | TP15 | DQ0 | GND |
| TP14 | CS# | GND | TP13 | BA1 | GND |
| TP12 | GND | GND | TP11 | BA0 | GND |
| TP10 | DM0 | GND | TP9 | DQS0 | GND |
| TP8 | NC | GND | TP7 | NC | GND |
| TP6 | NC | GND | TP5 | A1 | GND |
| TP4 | A0 | GND | TP3 | A10/AP | GND |
| TP2 | A3 | GND | TP1 | A2 | GND |

| Bottom Flex Wing | | | | | | |
|---|---|---|---|---|---|---|
| **Signal Name** | **Signal Name** | **Test Point** | | **Signal Name** | **Signal Name** | **Test Point** |
| GND | NC | TP1 | | GND | DQ8 | TP2 |
| GND | DQ10 | TP3 | | GND | DQ12 | TP4 |
| GND | DQ14 | TP5 | | GND | DQ1 | TP6 |
| GND | NC | TP7 | | GND | DQ3 | TP8 |
| GND | DQ5 | TP9 | | GND | DQ7 | TP10 |
| GND | NC | TP11 | | GND | NC | TP12 |
| GND | NC | TP13 | | GND | NC | TP14 |
| GND | NC | TP15 | | GND | NC | TP16 |
| GND | NC | TP17 | | GND | NC | TP18 |
| GND | NC | TP19 | | GND | NC | TP20 |
| GND | NC | TP21 | | GND | NC | TP22 |
| GND | NC | TP23 | | GND | NC | TP24 |

| Top Flex Wing | | | | | |
|---|---|---|---|---|---|
| **Test Point** | **Signal Name** | **Signal Name** | **Test Point** | **Signal Name** | **Signal Name** |
| TP24 | DQ24 | GND | TP23 | DQ26 | GND |
| TP22 | DQ28 | GND | TP21 | DQ30 | GND |
| TP20 | CK# | GND | TP19 | DQ17 | GND |
| TP18 | CK | GND | TP17 | DQ19 | GND |
| TP16 | DQ21 | GND | TP15 | DQ23 | GND |
| TP14 | NC | GND | TP13 | NC | GND |
| TP12 | NC | GND | TP11 | NC | GND |
| TP10 | NC | GND | TP9 | NC | GND |
| TP8 | NC | GND | TP7 | NC | GND |
| TP6 | NC | GND | TP5 | NC | GND |
| TP4 | NC | GND | TP3 | NC | GND |
| TP2 | NC | GND | TP1 | NC | GND |




**W2639A LPDDR BGA Probe Adapter Board Pin-Out for DDR2 Interposer Configuration (W2633A) – see Appendix**

| Left Flex Wing | | | | | | | Right Flex Wing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Signal Name** | **Signal Name** | **Test Point** | | **Signal Name** | **Signal Name** | **Test Point** | **Test Point** | **Signal Name** | **Signal Name** | **Test Point** | **Signal Name** | **Signal Name** |
| GND | NC | TP1 | | GND | NC | TP2 | TP24 | NC | GND | TP23 | NC | GND |
| GND | NC | TP3 | | GND | NC | TP4 | TP22 | NC | GND | TP21 | NC | GND |
| GND | NC | TP5 | | GND | DQ6 | TP6 | TP20 | LDQS# | GND | TP19 | DQ7 | GND |
| GND | NC | TP7 | | GND | DQ1 | TP8 | TP18 | LDQS | GND | TP17 | DQ0 | GND |
| GND | DQ3 | TP9 | | GND | DQ4 | TP10 | TP16 | DQ2 | GND | TP15 | DQ5 | GND |
| GND | VREF | TP11 | | GND | CKE | TP12 | TP14 | CK | GND | TP13 | ODT0 | GND |
| GND | WE# | TP13 | | GND | BA1 | TP14 | TP12 | CK# | GND | TP11 | RAS# | GND |
| GND | BA0 | TP15 | | GND | BA2 | TP16 | TP10 | CAS# | GND | TP9 | CS# | GND |
| GND | A1 | TP17 | | GND | A5 | TP18 | TP8 | A0 | GND | TP7 | A4 | GND |
| GND | A10 | TP19 | | GND | A3 | TP20 | TP6 | A2 | GND | TP5 | A6 | GND |
| GND | A7 | TP21 | | GND | A9 | TP22 | TP4 | A8 | GND | TP3 | RFU#2 | GND |
| GND | A12 | TP23 | | GND | NC | TP24 | TP2 | A11 | GND | TP1 | NC | GND |

**W2639A LPDDR BGA Probe Adapter Board Pin-Out for DDR2 Interposer Configuration (W2631A)- see Appendix**

| Left Flex Wing | | | | | | | Right Flex Wing | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Signal Name** | **Signal Name** | **Test Point** | | **Signal Name** | **Signal Name** | **Test Point** | **Test Point** | **Signal Name** | **Signal Name** | | **Test Point** | **Signal Name** | **Signal Name** |
| GND | UDM | TP1 | | GND | DQ14 | TP2 | TP24 | DQ15 | GND | | TP23 | DQ8 | GND |
| GND | DQ9 | TP3 | | GND | DQ11 | TP4 | TP22 | DQ10 | GND | | TP21 | DQ13 | GND |
| GND | DQ12 | TP5 | | GND | DQ6 | TP6 | TP20 | LDQS# | GND | | TP19 | DQ7 | GND |
| GND | LDM | TP7 | | GND | DQ1 | TP8 | TP18 | LDQS | GND | | TP17 | DQ0 | GND |
| GND | DQ3 | TP9 | | GND | DQ4 | TP10 | TP16 | DQ2 | GND | | TP15 | DQ5 | GND |
| GND | VREF | TP11 | | GND | CKE | TP12 | TP14 | CK | GND | | TP13 | ODT | GND |
| GND | WE# | TP13 | | GND | BA1 | TP14 | TP12 | CK# | GND | | TP11 | RAS# | GND |
| GND | BA0 | TP15 | | GND | BA2 | TP16 | TP10 | CAS# | GND | | TP9 | CS# | GND |
| GND | A1 | TP17 | | GND | A5 | TP18 | TP8 | A0 | GND | | TP7 | A4 | GND |
| GND | A10 | TP19 | | GND | A3 | TP20 | TP6 | A2 | GND | | TP5 | A6 | GND |
| GND | A7 | TP21 | | GND | NC | TP22 | TP4 | A8 | GND | | TP3 | RFU#2 | GND |
| GND | A12 | TP23 | | GND | A9 | TP24 | TP2 | A11 | GND | | TP1 | NC | GND |

**W2639A LPDDR BGA Probe Adapter Board Pin-Out for DDR3 Interposer Configuration (W3633A)**

| Left Flex Wing | | | | | | | Right Flex Wing | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Signal Name** | **Signal Name** | **Test Point** | | **Signal Name** | **Signal Name** | **Test Point** | **Test Point** | **Signal Name** | **Signal Name** | | **Test Point** | **Signal Name** | **Signal Name** |
| GND | DQ0 | TP1 | | GND | DQ2 | TP2 | TP24 | NC | GND | | TP23 | NC | GND |
| GND | DQS | TP3 | | GND | DQS# | TP4 | TP22 | NC | GND | | TP21 | NC | GND |
| GND | DQ6 | TP5 | | GND | NC | TP6 | TP20 | NC | GND | | TP19 | DQ1 | GND |
| GND | DQ4 | TP7 | | GND | RAS# | TP8 | TP18 | DM | GND | | TP17 | DQ3 | GND |
| GND | ODT1 | TP9 | | GND | CAS# | TP10 | TP16 | DQ7 | GND | | TP15 | DQ5 | GND |
| GND | ODT0 | TP11 | | GND | CS0# | TP12 | TP14 | CK | GND | | TP13 | CKE1 | GND |
| GND | WE# | TP13 | | GND | CS1# | TP14 | TP12 | CK# | GND | | TP11 | CKE0 | GND |
| GND | BA2 | TP15 | | GND | BA0 | TP16 | TP10 | A10/AP | GND | | TP9 | A15 | GND |
| GND | A0 | TP17 | | GND | A5 | TP18 | TP8 | A12/BC# | GND | | TP7 | A4 | GND |
| GND | A3 | TP19 | | GND | A2 | TP20 | TP6 | BA1 | GND | | TP5 | A1 | GND |
| GND | A7 | TP21 | | GND | GND | TP22 | TP4 | A6 | GND | | TP3 | A11 | GND |
| GND | RESET# | TP23 | | GND | A13 | TP24 | TP2 | A8 | GND | | TP1 | A14 | GND |

**W2639A LPDDR BGA Probe Adapter Board Pin-Out for DDR3 Interposer Configuration (W3631A)**

| Left Flex Wing | | | | | | |
|---|---|---|---|---|---|---|
| **Signal Name** | **Signal Name** | **Test Point** | | **Signal Name** | **Signal Name** | **Test Point** |
| GND | DQU7 | TP1 | | GND | DQU5 | TP2 |
| GND | DQU1 | TP3 | | GND | DQU3 | TP4 |
| GND | DQL0 | TP5 | | GND | DQL6 | TP6 |
| GND | DQL2 | TP7 | | GND | DQL4 | TP8 |
| GND | ODT1 | TP9 | | GND | RAS# | TP10 |
| GND | ODT0 | TP11 | | GND | CS0# | TP12 |
| GND | CAS# | TP13 | | GND | CS1# | TP14 |
| GND | WE# | TP15 | | GND | BA0 | TP16 |
| GND | A3 | TP17 | | GND | A5 | TP18 |
| GND | A0 | TP19 | | GND | A2 | TP20 |
| GND | A7 | TP21 | | GND | A9 | TP22 |
| GND | RESET | TP23 | | GND | A13 | TP24 |

| Right Flex Wing | | | | | |
|---|---|---|---|---|---|
| **Test Point** | **Signal Name** | **Signal Name** | **Test Point** | **Signal Name** | **Signal Name** |
| TP24 | DQU4 | GND | TP23 | DQU6 | GND |
| TP22 | DQSU# | GND | TP21 | DQSU | GND |
| TP20 | DQU2 | GND | TP19 | DML | GND |
| TP18 | DQU0 | GND | TP17 | DQL1 | GND |
| TP16 | DQL3 | GND | TP15 | DQL7 | GND |
| TP14 | DQL5 | GND | TP13 | CK# | GND |
| TP12 | CK | GND | TP11 | CKE1 | GND |
| TP10 | CKE0 | GND | TP9 | A10/AP | GND |
| TP8 | A12/BC# | GND | TP7 | A4 | GND |
| TP6 | BA1 | GND | TP5 | A1 | GND |
| TP4 | A6 | GND | TP3 | A11 | GND |
| TP2 | A8 | GND | TP1 | A14 | GND |

# 3. Setting Up the Logic Analysis System

The mapping of specific signals to logic analyzer channels depends on:

- Which DRAMs on a DIMM are probed
- Which probe you are using
- How the single ended logic analyzer cable adapters are arranged when connecting to the LPDDR DRAM BGA probes

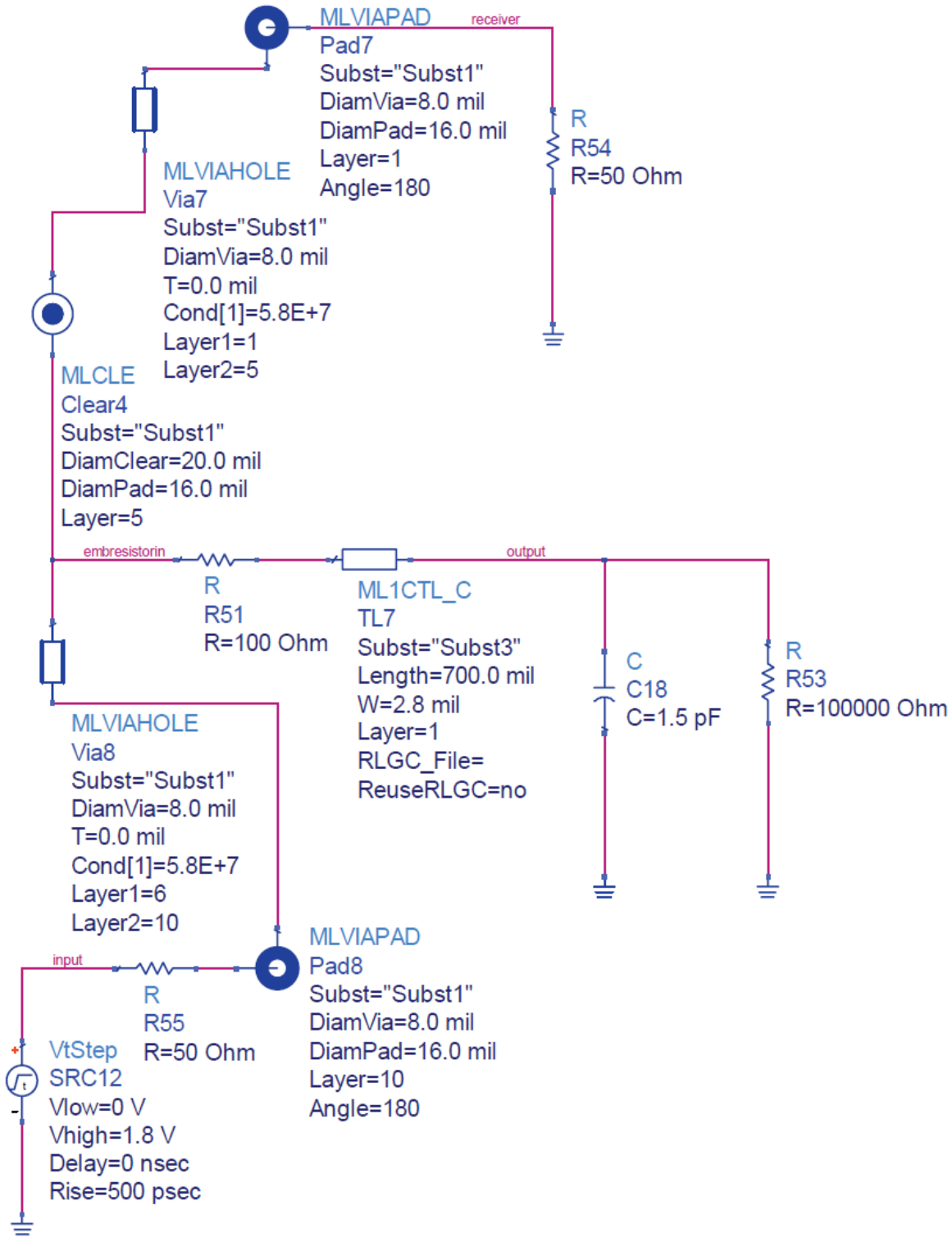
Because of these dependencies, there is no single logic analyzer configuration file setup, and no configuration file is supplied with the probes. The logic analyzer Buses/Signals setup dialog will allow you to assign descriptive labels to each analyzer channel that associate each channel with the particular DRAM and DRAM signal being probed.

**To Save a Configuration File**

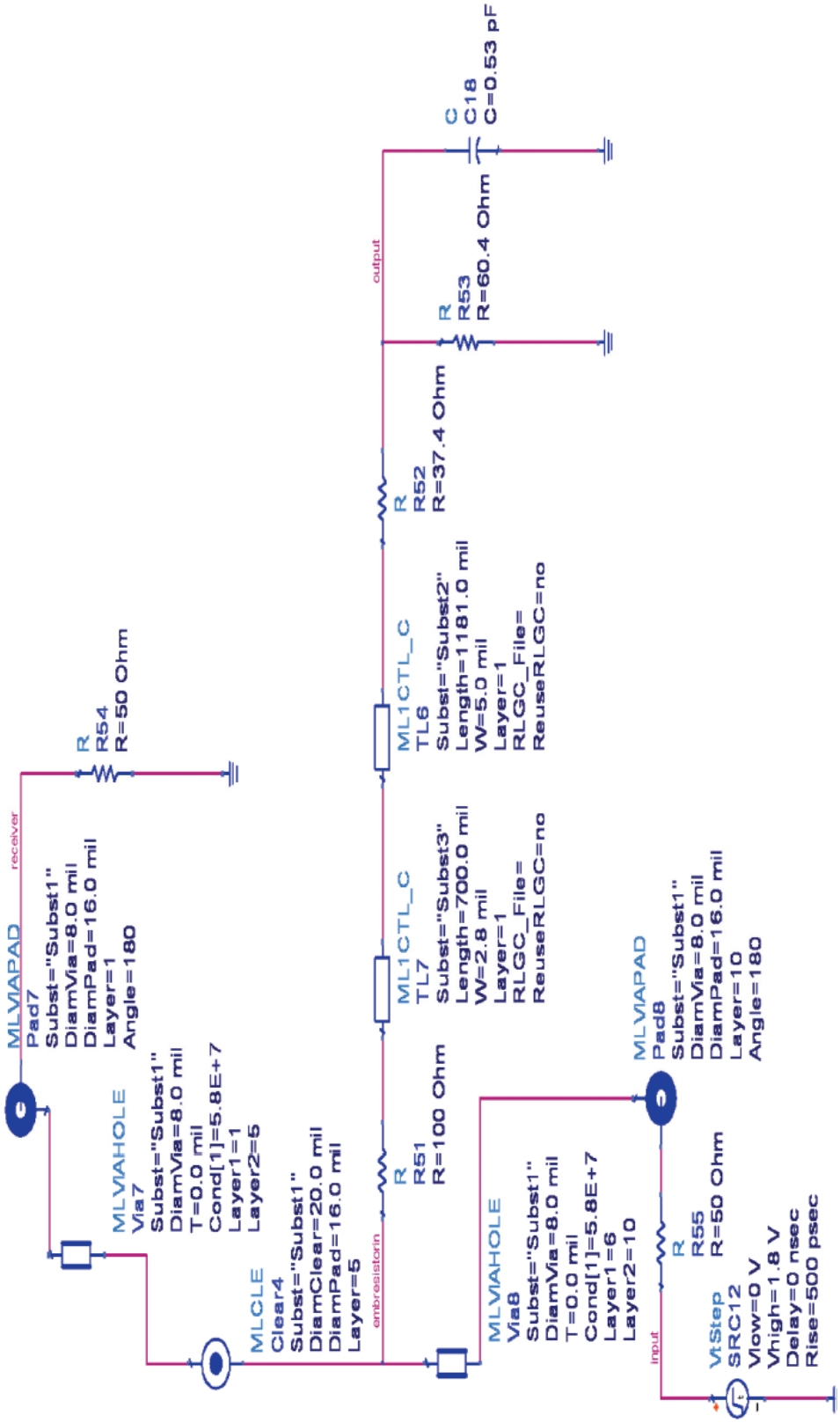
After you set up the logic analyzer, it is strongly recommended that you save the configuration.

To save your work, select **File** > **Save As …** and save the configuration as an ALA format file. ALA format configuration files are more complete and efficient than XML format configuration files. See the logic analyzer online help for more information on these formats.

# 4. Characteristics, Regulatory, and Safety Information




**W2637A and W2638A Probes with logic analyzer cable (E5384A/E5826A)**




**W2637A and W2638A Probes with W2639A Oscilloscope Adapter Board**

# Spice Decks for W2637A and W2638A Probes

```
**********************************************************************************
***
***          LPDDR Interposer + Logic Analyzer Cable (E5384A/E5826A/E5827A) SPICE Model
***
**********************************************************************************

*bbspice subcircuit with consecutive port numbers.
.SUBCKT bbspice_LAcablelpddr_subckt      port_1  port_2  gnd_0

* PORT_1
vi_1        port_1      _net_1      0.00000000000000e+000
vb_1        _net_4      _net_5      0.00000000000000e+000
R_Z0_1      _net_1      _net_2      5.00000000000000e+001          NOISE=0
H_b_1       _net_2      gnd_0       vb_1        1.41421356237310e+001
E_v_1       _net_3      gnd_0       port_1      gnd_0       7.07106781186548e-002
H_i_1       _net_4      _net_3      vi_1        3.53553390593274e+000


G_C_1_1  _net_5      gnd_0       _net_11     gnd_0       -3.22608552467231e+009
G_C_1_2  _net_5      gnd_0       _net_12     gnd_0       -1.85622867007219e+009
G_C_1_3  _net_5      gnd_0       _net_13     gnd_0       -4.24046553324636e+009
G_C_1_4  _net_5      gnd_0       _net_14     gnd_0       -4.25728470875830e+009
G_C_1_5  _net_5      gnd_0       _net_15     gnd_0       1.05067661912510e+010
G_C_1_6  _net_5      gnd_0       _net_16     gnd_0       -6.49079078505455e+009
G_C_1_7  _net_5      gnd_0       _net_17     gnd_0       3.08198380221454e+009
G_C_1_8  _net_5      gnd_0       _net_18     gnd_0       7.23969632915889e+009

* PORT_2
vi_2        port_2      _net_6      0.00000000000000e+000
vb_2        _net_9      _net_10     0.00000000000000e+000
R_Z0_2      _net_6      _net_7      5.00000000000000e+001          NOISE=0
H_b_2       _net_7      gnd_0       vb_2        1.41421356237310e+001
E_v_2       _net_8      gnd_0       port_2      gnd_0       7.07106781186548e-002
H_i_2       _net_9      _net_8      vi_2        3.53553390593274e+000


G_C_2_1  _net_10     gnd_0       _net_11     gnd_0       1.05067661912510e+010
G_C_2_2  _net_10     gnd_0       _net_12     gnd_0       -6.49079078505455e+009
G_C_2_3  _net_10     gnd_0       _net_13     gnd_0       3.08198380221454e+009
G_C_2_4  _net_10     gnd_0       _net_14     gnd_0       7.23969632915889e+009
G_C_2_5  _net_10     gnd_0       _net_15     gnd_0       3.82698652097210e+010
G_C_2_6  _net_10     gnd_0       _net_16     gnd_0       -5.59332217972397e+010
G_C_2_7  _net_10     gnd_0       _net_17     gnd_0       -1.12021520702025e+010
G_C_2_8  _net_10     gnd_0       _net_18     gnd_0       -6.74361603121270e+009

* STATE_1
C_1         _net_11     gnd_0       1.00000000000000e-011
G_A_1_1  _net_11     gnd_0       _net_11     gnd_0       1.34401797487851e-001
G_B_1_1  _net_11     gnd_0       _net_4      gnd_0       -1.00000000000000e-011

* STATE_2
C_2         _net_12     gnd_0       1.00000000000000e-011
G_A_2_2  _net_12     gnd_0       _net_12     gnd_0       2.47566797545524e-001
G_B_2_1  _net_12     gnd_0       _net_4      gnd_0       -1.00000000000000e-011

* STATE_3
C_3         _net_13     gnd_0       1.00000000000000e-011
G_A_3_3  _net_13     gnd_0       _net_13     gnd_0       1.64751890165784e-001
G_A_3_4  _net_13     gnd_0       _net_14     gnd_0       -6.43501358659259e-001
G_B_3_1  _net_13     gnd_0       _net_4      gnd_0       -2.00000000000000e-011

* STATE_4
C_4         _net_14     gnd_0       1.00000000000000e-011
G_A_4_4  _net_14     gnd_0       _net_14     gnd_0       1.64751890165784e-001
G_A_4_3  _net_14     gnd_0       _net_13     gnd_0       6.43501358659259e-001
```

```
* STATE_5
C_5         _net_15    gnd_0      1.00000000000000e-011
G_A_5_5  _net_15    gnd_0      _net_15    gnd_0      1.34401797487851e-001
G_B_5_2  _net_15    gnd_0      _net_9      gnd_0      -1.00000000000000e-011

* STATE_6
C_6         _net_16    gnd_0      1.00000000000000e-011
G_A_6_6  _net_16    gnd_0      _net_16    gnd_0      2.47566797545524e-001
G_B_6_2  _net_16    gnd_0      _net_9      gnd_0      -1.00000000000000e-011

* STATE_7
C_7         _net_17    gnd_0      1.00000000000000e-011
G_A_7_7  _net_17    gnd_0      _net_17    gnd_0      1.64751890165784e-001
G_A_7_8  _net_17    gnd_0      _net_18    gnd_0      -6.43501358659259e-001
G_B_7_2  _net_17    gnd_0      _net_9      gnd_0      -2.00000000000000e-011

* STATE_8
C_8         _net_18    gnd_0      1.00000000000000e-011
G_A_8_8  _net_18    gnd_0      _net_18    gnd_0      1.64751890165784e-001
G_A_8_7  _net_18    gnd_0      _net_17    gnd_0      6.43501358659259e-001


.ENDS  bbspice_LAcablelpddr_subckt
****************************************


****************************************
* S-based subckt


*bbspice subcircuit with external port numbers.

.SUBCKT bbspice_LAcablelpddr                    1          2          0

x_          1          2          0          bbspice_LAcablelpddr_subckt

.ENDS  bbspice_LAcablelpddr
********************************************************************************
```

```
********************************************************************************
***
***                                  LPDDR Interposer + W2639A SPICE Model
***
********************************************************************************


*bbspice subcircuit with consecutive port numbers.
.SUBCKT bbspice_syslpddr_subckt              port_1  port_2  gnd_0

* PORT_1
vi_1        port_1      _net_1      0.00000000000000e+000
vb_1        _net_4      _net_5      0.00000000000000e+000
R_Z0_1      _net_1      _net_2      5.00000000000000e+001          NOISE=0
H_b_1       _net_2      gnd_0       vb_1        1.41421356237310e+001
E_v_1       _net_3      gnd_0       port_1      gnd_0       7.07106781186548e-002
H_i_1       _net_4      _net_3      vi_1        3.53553390593274e+000


G_C_1_1  _net_5      gnd_0       _net_11     gnd_0       1.24005027897216e+009
G_C_1_2  _net_5      gnd_0       _net_12     gnd_0       -1.56329103409242e+009
G_C_1_3  _net_5      gnd_0       _net_13     gnd_0       -2.43281969714982e+009
G_C_1_4  _net_5      gnd_0       _net_14     gnd_0       2.45669672903938e+010
G_C_1_5  _net_5      gnd_0       _net_15     gnd_0       -2.52103573644686e+009
G_C_1_6  _net_5      gnd_0       _net_16     gnd_0       -6.13849694652838e+009
G_C_1_7  _net_5      gnd_0       _net_17     gnd_0       4.55445764882538e+009
G_C_1_8  _net_5      gnd_0       _net_18     gnd_0       6.49291629738857e+010

* PORT_2
vi_2        port_2      _net_6      0.00000000000000e+000
vb_2        _net_9      _net_10     0.00000000000000e+000
R_Z0_2      _net_6      _net_7      5.00000000000000e+001          NOISE=0
H_b_2       _net_7      gnd_0       vb_2        1.41421356237310e+001
E_v_2       _net_8      gnd_0       port_2      gnd_0       7.07106781186548e-002
H_i_2       _net_9      _net_8      vi_2        3.53553390593274e+000


G_C_2_1  _net_10     gnd_0       _net_11     gnd_0       -2.52103573644686e+009
G_C_2_2  _net_10     gnd_0       _net_12     gnd_0       -6.13849694652838e+009
G_C_2_3  _net_10     gnd_0       _net_13     gnd_0       4.55445764882538e+009
G_C_2_4  _net_10     gnd_0       _net_14     gnd_0       6.49291629738857e+010
G_C_2_5  _net_10     gnd_0       _net_15     gnd_0       -1.11104456711947e+010
G_C_2_6  _net_10     gnd_0       _net_16     gnd_0       1.89160369519661e+010
G_C_2_7  _net_10     gnd_0       _net_17     gnd_0       -3.48001162309017e+009
G_C_2_8  _net_10     gnd_0       _net_18     gnd_0       -4.14924945810738e+011

* STATE_1
C_1         _net_11     gnd_0       1.00000000000000e-011
G_A_1_1  _net_11     gnd_0       _net_11     gnd_0       9.58822912609048e-002
G_A_1_2  _net_11     gnd_0       _net_12     gnd_0       -7.04839193299830e-002
G_B_1_1  _net_11     gnd_0       _net_4      gnd_0       -2.00000000000000e-011

* STATE_2
C_2         _net_12     gnd_0       1.00000000000000e-011
G_A_2_2  _net_12     gnd_0       _net_12     gnd_0       9.58822912609048e-002
G_A_2_1  _net_12     gnd_0       _net_11     gnd_0       7.04839193299830e-002

* STATE_3
C_3         _net_13     gnd_0       1.00000000000000e-011
G_A_3_3  _net_13     gnd_0       _net_13     gnd_0       2.01712271022166e-001
G_A_3_4  _net_13     gnd_0       _net_14     gnd_0       -1.81352782179138e-002
G_B_3_1  _net_13     gnd_0       _net_4      gnd_0       -2.00000000000000e-011

* STATE_4
C_4         _net_14     gnd_0       1.00000000000000e-011
G_A_4_4  _net_14     gnd_0       _net_14     gnd_0       2.01712271022166e-001
G_A_4_3  _net_14     gnd_0       _net_13     gnd_0       1.81352782179138e-002
```

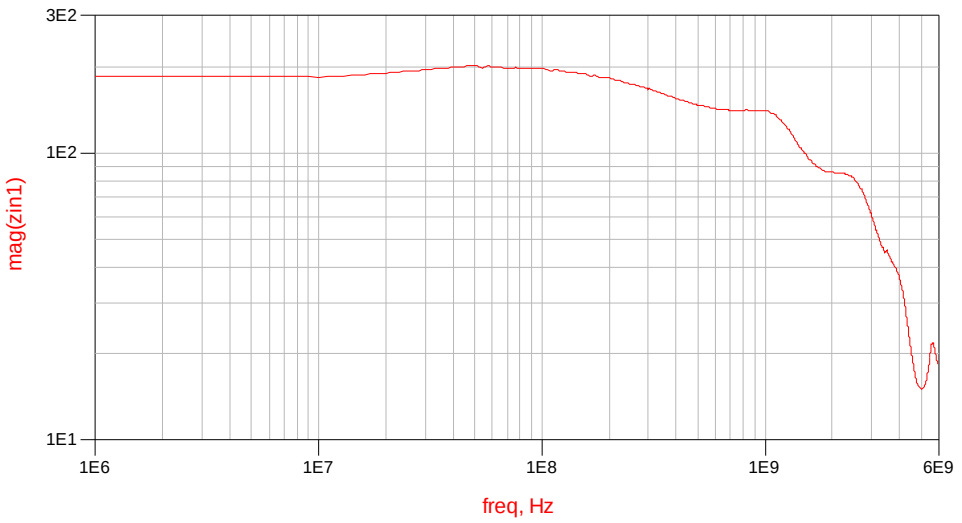
```
* STATE_5
C_5         _net_15    gnd_0       1.00000000000000e-011
G_A_5_5  _net_15    gnd_0       _net_15    gnd_0       9.58822912609048e-002
G_A_5_6  _net_15    gnd_0       _net_16    gnd_0       -7.04839193299830e-002
G_B_5_2  _net_15    gnd_0       _net_9      gnd_0       -2.00000000000000e-011

* STATE_6
C_6         _net_16    gnd_0       1.00000000000000e-011
G_A_6_6  _net_16    gnd_0       _net_16    gnd_0       9.58822912609048e-002
G_A_6_5  _net_16    gnd_0       _net_15    gnd_0       7.04839193299830e-002

* STATE_7
C_7         _net_17    gnd_0       1.00000000000000e-011
G_A_7_7  _net_17    gnd_0       _net_17    gnd_0       2.01712271022166e-001
G_A_7_8  _net_17    gnd_0       _net_18    gnd_0       -1.81352782179138e-002
G_B_7_2  _net_17    gnd_0       _net_9      gnd_0       -2.00000000000000e-011

* STATE_8
C_8         _net_18    gnd_0       1.00000000000000e-011
G_A_8_8  _net_18    gnd_0       _net_18    gnd_0       2.01712271022166e-001
G_A_8_7  _net_18    gnd_0       _net_17    gnd_0       1.81352782179138e-002


.ENDS  bbspice_syslpddr_subckt
****************************************


****************************************
* S-based subckt


*bbspice subcircuit with external port numbers.

.SUBCKT bbspice_syslpddr                    1           2           0

x_          1           2           0           bbspice_syslpddr_subckt

.ENDS  bbspice_syslpddr
********************************************************************************
```

## Electrical Characteristics

The following electrical characteristics are not specifications, but are typical electrical characteristics.

**Table 1** Electrical characteristics

| | |
|---|---|
| **Operating Transfer Rate** | W2637A + E5384/E5826: 255 Mb/s<br>W2638A + E5384/E5826: 255 Mb/s<br>W2637A + W2639A: 500 Mb/s<br>W2638A + W2639A: 500 Mb/s |
| **Bandwidth (3 dB)** | W2637A + E5384/E5826: 510 MHz<br>W2638A + E5384/E5826: 510 MHz<br>W2637A + W2639A: 1.5 GHz<br>W2638A + W2639A: 1.5 GHz |
| **Rise time** | W2637A + E5384/E5826: 686 ps<br>W2638A + E5384/E5826: 686 ps<br>W2637A + W2639A: 233 ps<br>W2638A + W2639A: 233 ps |
| **Input Impedance** | W2637A + W2639A: 200 Ω<br>W2638A + W2639A: 200 Ω |




**Input impedance of W2637A/W2638A with W2639A Oscilloscope Adapter Board**

## Operating Characteristics

The following operating characteristics are not specifications, but are typical operating characteristics for the analysis of the W2637A and W2638A probes with the oscilloscope probe.

**Table 2** Environmental characteristics (Operating)

| | |
|---|---|
| **Temperature** | 0° to + 100° C |
| **Altitude** | 4,600 m (15,000 ft) |
| **Humidity** | Up to 50% noncondensing. Avoid sudden, extreme temperature changes which could cause condensation on the circuit board.<br>For indoor use only. |

## Safety Notices

This apparatus has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Measuring Apparatus, and has been supplied in a safe condition. Before applying power, verify that the correct safety precautions are taken (see the following warnings). In addition, note the external markings on the instrument that are described under "Safety Symbols."

## Warnings

Use only the recommended power supply.

If you energize this instrument by an auto transformer (for voltage reduction or mains isolation), the common terminal must be connected to the earth terminal of the power source.

If it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.

Service instructions are for trained service personnel. To avoid dangerous electric shock, do not perform any service unless qualified to do so. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

Do not install substitute parts or perform any unauthorized modification to the instrument.

Capacitors inside the instrument may retain a charge even if the instrument is disconnected from its source of supply.

Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Do not use the instrument in a manner not specified by the manufacturer.

## Safety Symbols

Instruction manual symbol: the product is marked with this symbol when it is necessary for you to refer to the instruction manual in order to protect against damage to the product.

Hazardous voltage symbol

Earth terminal symbol: Used to indicate a circuit common connected to grounded chassis

## Regulatory Information

China RoHS non-restricted for W2637A, W2638A, and W2639A


China RoHS restricted for E5384, E5826/7

# Appendix A: W2639A Rework Instruction Guide – For use when W2639A Oscilloscope Probe Adapter Board is used with DDR2 BGA probe (W2631A and W2633A)

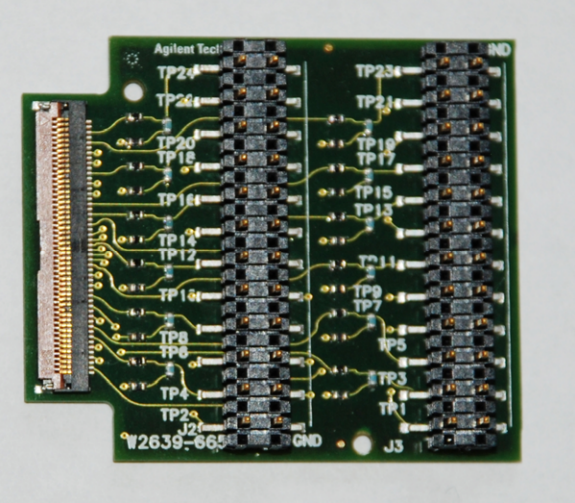
## Introduction

This appendix provides rework information for the following Agilent product:

- W2639A Oscilloscope Probe Adapter Board

The W2639A is designed to provide high bandwidth performance to the oscilloscope with proper termination. However, for use with the DDR2 BGA probe, the VREF point should not be terminated. The rework instructions provide a workaround to correct the termination point of VREF on the W2639A Oscilloscope Probe Adapter Board.

The figure below shows the W2639A Oscilloscope Probe Adapter Board.



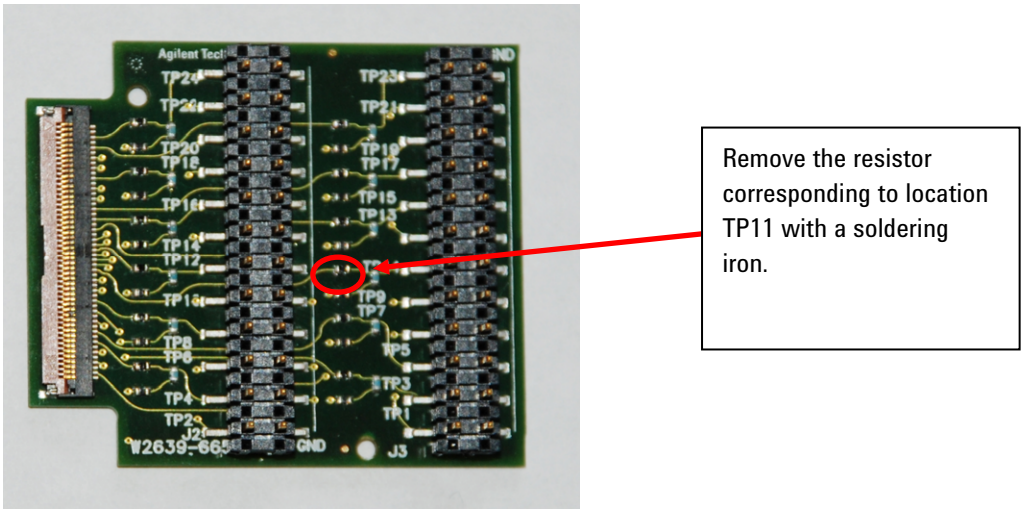

W2639A Oscilloscope Probe Adapter Board

## Equipment Required for Rework

- W2639A Oscilloscope Probe Board Adapter (1 of 2)
- Soldering iron

## Rework Instructions to Remove VREF Termination on W2639A DDR2 Oscilloscope Adapter Board When Used With W2631A DDR2 x16 BGA Probe

1. The VREF signal is connected to the W2639A Oscilloscope Probe Adapter Board via the left flex wing of the W2631A DDR2 BGA probe on TP11 as shown in the table on the next page.
2. Remove the 37.4 ohm resistor located near TP11 with a soldering iron as shown in the figure below to disconnect the signal from GND. This will open the path to VREF.




Location of the 37.4ohm resistor for TP11 on the W2639A Oscilloscope Probe Adapter Board

3. Label the reworked W2639A Oscilloscope Probe Adapter Board “LEFT”. The reworked W2639A must only connect to the left flex wing of the W2631A DDR2 BGA probe.
4. The rework instructions may be repeated for the following BGA probes with reference to the pin-out tables shown in earlier sections of this user’s guide.
   - W2631A x16 DDR2 BGA probe
   - W2633A x8 DDR2 BGA probe

**Note: Please contact Agilent to confirm the exact location of the resistor.**

W2639A BGA scope probe adapter pin-out for W2631A

| Left Flex Wing | | | | | | |
|---|---|---|---|---|---|---|
| Signal Name | Signal Name | Test Point | | Signal Name | Signal Name | Test Point |
| GND | UDM | TP1 | | GND | DQ14 | TP2 |
| GND | DQ9 | TP3 | | GND | DQ11 | TP4 |
| GND | DQ12 | TP5 | | GND | DQ6 | TP6 |
| GND | LDM | TP7 | | GND | DQ1 | TP8 |
| GND | DQ3 | TP9 | | GND | DQ4 | TP10 |
| **GND** | **VREF** | **TP11** | | GND | CKE | TP12 |
| GND | WE# | TP13 | | GND | BA1 | TP14 |
| GND | BA0 | TP15 | | GND | BA2 | TP16 |
| GND | A1 | TP17 | | GND | A5 | TP18 |
| GND | A10 | TP19 | | GND | A3 | TP20 |
| GND | A7 | TP21 | | GND | NC | TP22 |
| GND | A12 | TP23 | | GND | A9 | TP24 |

| Right Flex Wing | | | | | | |
|---|---|---|---|---|---|---|
| Test Point | Signal Name | Signal Name | | Test Point | Signal Name | Signal Name |
| TP24 | DQ15 | GND | | TP23 | DQ8 | GND |
| TP22 | DQ10 | GND | | TP21 | DQ13 | GND |
| TP20 | LDQS# | GND | | TP19 | DQ7 | GND |
| TP18 | LDQS | GND | | TP17 | DQ0 | GND |
| TP16 | DQ2 | GND | | TP15 | DQ5 | GND |
| TP14 | CK | GND | | TP13 | ODT | GND |
| TP12 | CK# | GND | | TP11 | RAS# | GND |
| TP10 | CAS# | GND | | TP9 | CS# | GND |
| TP8 | A0 | GND | | TP7 | A4 | GND |
| TP6 | A2 | GND | | TP5 | A6 | GND |
| TP4 | A8 | GND | | TP3 | RFU#2 | GND |
| TP2 | A11 | GND | | TP1 | NC | GND |

Manual Part Number W2638-97002
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